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December 1971
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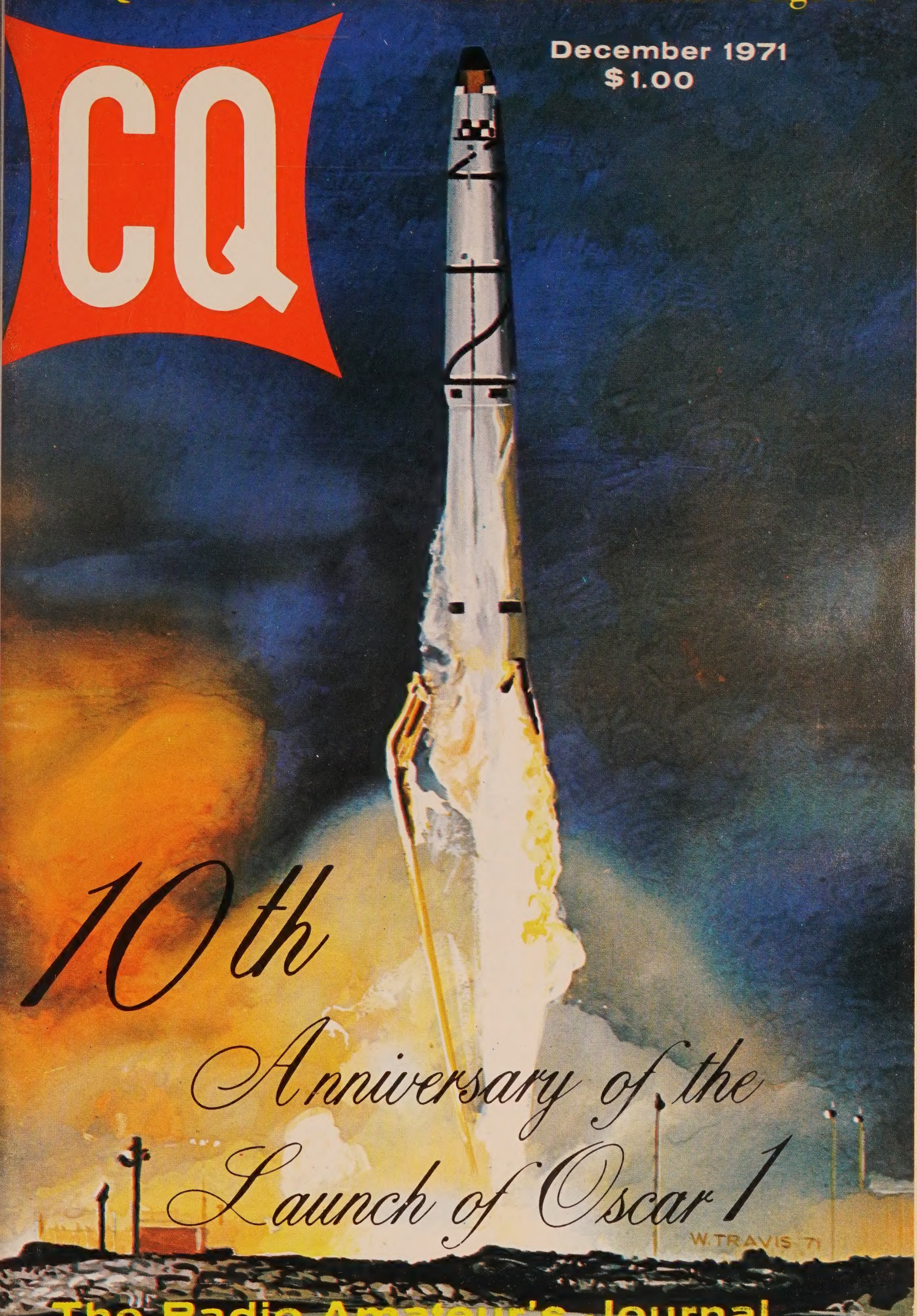

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The Radio Amateur's Journal

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The SB-102 is the value leader because you build it yourself to save on initial investment and service. Simple circuit board/wiring harness construction gets it all together. Order your round-trip ticket to the world now — the famous Heathkit SB-102 SSB/CW Transceiver.

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A Heath-designed DC calibrator is furnished assembled with every IM-102. A unique transfer method, described in the manual, provides accurate AC voltage calibration. All solid-state circuitry incorporates cold cathode readout tubes and a "memory" circuit to assure stable, non-blinking operation. Kit includes standard banana jack connectors complete with test leads. Assembles in approximately 10 hours. Order yours, and step up to digital instrumentation at analog prices.

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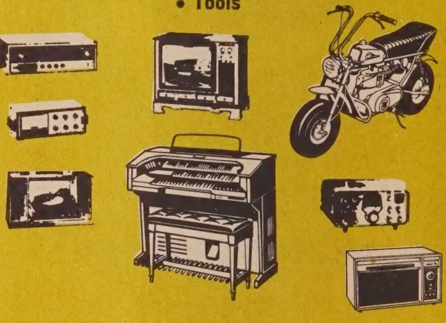

S+N/N ratio of less than 0.35 uV for 10 dB — with front-panel selection of built-in 2.1 kHz SSB crystal filter or optional 400 Hz crystal filter. And there's a dial resettable to 200 Hz; 180 W PEP SSB input, 170 W CW input; switch selection of upper or lower sideband and CW; built-in sidetone for monitoring; built-in 100 kHz crystal calibrator; triple action level control to reduce clipping and distortion; built-in VOX, and complete metering.

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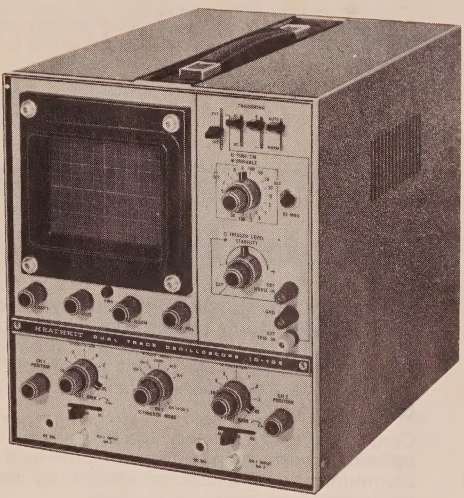

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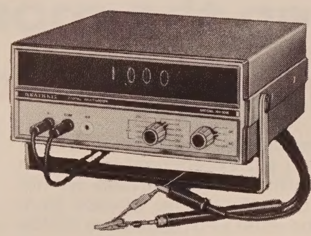

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A Heath-designed DC calibrator is furnished assembled with every IM-102. A unique transfer method, described in the manual, provides accurate AC voltage calibration. All solid-state circuitry incorporates cold cathode readout tubes and a "memory" circuit to assure stable, non-blinking operation. Kit includes standard banana jack connectors complete with test leads. Assembles in approximately 10 hours. Order yours, and step up to digital instrumentation at analog prices.

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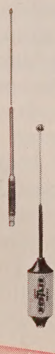

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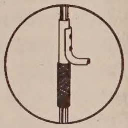

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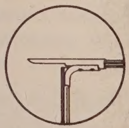

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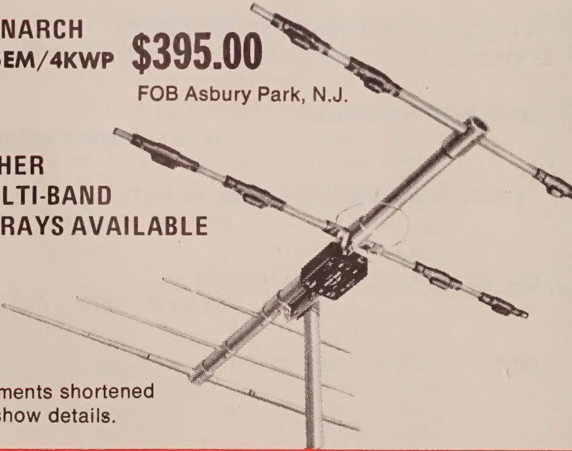

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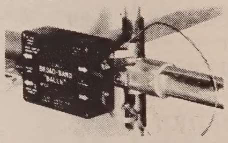

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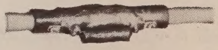

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Amateur radio has entered the Space Age.

Ten years ago this month, December 12, 1961, the first amateur radio space satellite was launched from Vandenberg Air Force Base in California.

For those who experienced it, it still stirs exciting memories. The space age itself was still in its infancy. After all, only four years prior it had all begun with the USSR's Sputnik in October 1957, and in the short span of two years the idea of an amateur satellite had moved from the pages of *CQ* to an Orbiting Satellite Carrying Amateur Radio – OSCAR. The friendly di-di-di- dit di-dit on 145 mc became an instant symbol of a new era for amateur radio – The Space Communications Era.

To that dedicated group of pioneers who formed the nucleus of the OSCAR effort, Orr, Gabrielson, Marshal, Jacobs and more, we extend our congratulations on this tenth anniversary of their initial achievement. To the second generation of amateur space communications specialists, represented by AMSAT, we offer good wishes for continued success.

The Artful Way of Covering a Cover

Recent correspondence has leaned heavily towards the super-quality of the majority of *CQ's* covers over the past year or so. We suspect that the mail is a result of such special design efforts as appeared on the February, March, June, September, and November issues. So yielding to demands that we cease hiding his light under a bushel, we would like to direct credit for these superb cover designs to Art Director Bill Travis. Bill is a veteran of many years behind the drawing board at Grumman Aerospace doing art design work for their aircraft and space projects. For the last two years Bill, a grandfather of twins, has directed his talent towards *CQ*. Hence, the covers. This month, another Travis design is featured: The launch of OSCAR I, a watercolor rendering from photographs.

We have also had requests for large-size full-color copies of some of Bill's renderings, but until the demand is great enough to warrant printing a few hundred, we'll have to disappoint numerous readers.

Holiday Greetings

Although this is being written in early October, we'd like to wish a grand and joyous Christmas season to all our readers, from the people who make the magazine go each month: John, K4IIF; Frank, W1WY; Fred, W2IWC; George, W3ASK; Ed, W2GT; Jerry, WA6GLD; Gordon White; Glen, K9STH; Dick, WA2LRO; Jack, WA2FPE; Bill, W2-AEF; Joan; Bill Travis; Dave Lance; Al, K2EEK, and vy 73 from Dick, K2MGA.

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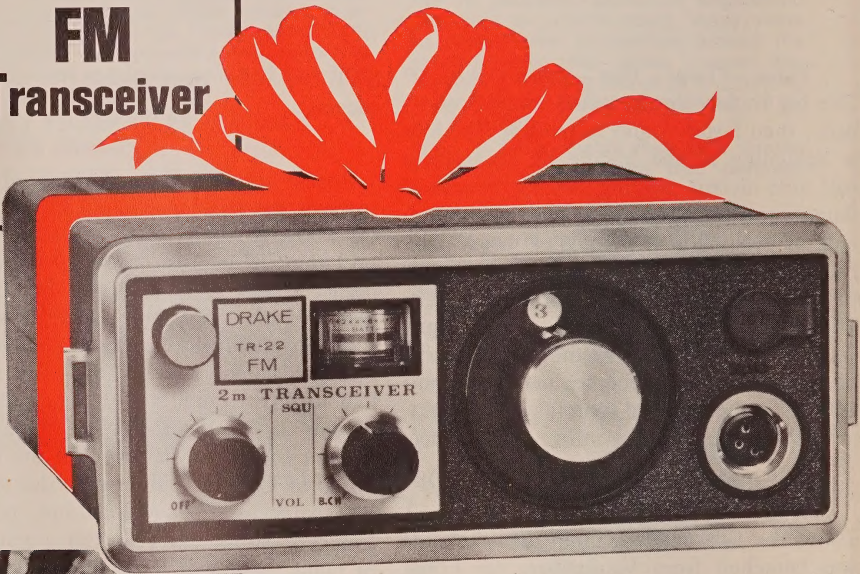

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OUR READERS SAY

Spurious Responses

Editor, *CQ:*

As a math teacher as well as a ham I appreciated the article in August *CQ* regarding calculation of spurious signals generated in the mixing process by combined graphical and analytic methods. I dug out the original article in the September 1965 issue and found the charts presented there of considerable help.

I have two suggestions for anyone seeking to use the methods presented in Mr. Perolo's article. First, the drafting on page 25 is slightly in error on some of the lines. I discovered this in trying to use the graph. One of the worst is the 2/9 line which should cross at coordinates (18, 4) but appears to cross at about (17.6, 4), a significant error in careful use. The 1/6 line is just as bad. It would be wise to draw a careful graph on standard 8½ by 11 graph paper if one plans to make extensive use of this sort of calculations. I have drawn such a graph which I believe to be accurate. For 5¢ (my cost of xerox) and a self-addressed stamped envelope I will send anyone who wants one, a copy of my graph.

Second, the actual use of the equation can be simplified. To justify his work in using the equation $y=mx$, the author uses several figures taken from the edge of the graph; but one does not have to use the figures he uses to calculate m. The slope, m, can be read directly from the fraction given at the end of the line and used as is or changed to decimal as desired. For example for 9 mc, an intersect on 4/7 line can be written $y=(4/7)\ (9)=5.14$. No reference need be made to (20, 80/7).

Thanks again for a good article.

D. Wilson Cooke, WA4RHT
7032 Claudia Dr.
Columbia, S.C.

It isn't April, but...

Editor, *CQ:*

After considering many ways of getting away from QRM on the h.f. ham bands, I've finally found the answer. As it turns out, there is available a complete spectrum which heretofore has not been utilized. Of course, the big disadvantage in working such a band is that there is no one to QSO with. Therefore, this letter. I'm hopeful other rag chewers will join me on these frequencies where we can enjoy essentially a QRM-free QSO.

The whole idea came to me while I was studying the operation of error multipliers as used in frequency stability measurements. The idea of the error multiplier is to simply multiply a frequency along with its instabilities and heterodyne it back to the original value. The error remains multiplied by whatever multiplying factor was used. For example, see fig. 1. If the 1 mc oscillator has an offset of 1 c.p.s., the offset is 9 c.p.s. after this simple error multiplier.

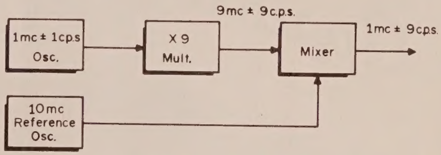


Figure 1

Now, take for example, an oscillator which can be tuned 100 kc either side of 1 mc. See fig. 2. By multiplying and mixing twice, the resultant output can be seen as 1 mc ±8.1 mc. By tuning the output of the final mixer to the difference frequency, the resulting frequency is negative (1 mc −8.1 mc= −7.1 mc) and lies in the negative 40 meter band. Since the oscillator is tunable, it may also be used on the −80 meter band.

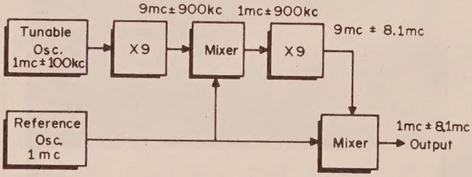


Figure 2

At first I was unable to tune negative frequencies on my receiver to determine if the idea really worked. By experimentation, however, I found that by using the same technique to generate the local oscillator signal in my superhet, that the receiver worked fine at these frequencies.

The only signal I've heard so far is a strange one—a code I've not heard before. Anyway, I'm looking forward to working some good, QRM-free QSO's. Won't some of your readers join me?

Ken Archbold, K3RDF
Mechanicsburg, Pa. 17055

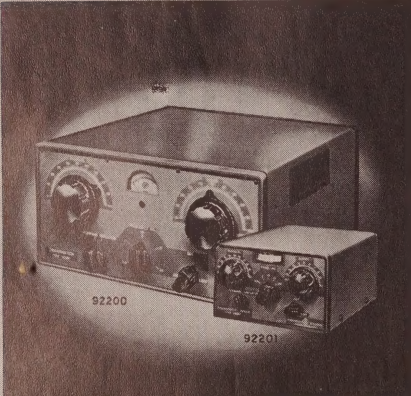
Brasspounding

Editor, *CQ:*

I find the letter to the editor in *CQ* of July '71 by Mr. Leek of interest. I have been operating c.w. since 1924, although at that time the transmitters were, in numbers, mostly spark gap affairs, c.w. being a bit rare. C.w. has been in process of being phased out for at least 35 years.

[*Continued on page 85*]

Designed for Application



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Allows a transmitter to work into the 50 ohm unbalanced load for which it was designed. Converts a multi-band antenna to 50 ohms at all amateur frequencies between 3.5 and 29.7 MC. Match 10 to 300 ohm unbalanced loads.

92200 TRANSMATCH handles a kw.

92201 TRANSMATCH JUNIOR handles 150 w.

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Announcements

Reciprocal Licensing In Denmark

We have been made aware that the Danish amateur radio organization EDR (Experimenterende Danske Radioamatorer has been working for the granting of wider reciprocal licensing agreements between Denmark and other countries. They are also working for a series of short term licenses for vacationeers. EDR is now seeking any and all information regarding licensed amateurs around the world who have been denied an amateur license in Denmark. They hope to present this information to their government along with other material to help their cause. Please send all information to: EDR, P.O. Box 335, DK 9100, Aalborg, Denmark.

Amateur Newsletter

Armond Noble, WB6AUH, is putting out a newsletter for amateurs interested in the international friendship, humanitarian and public aspects of amateur radio. For a free copy write to 2509 Donner Way, Sacramento, California 95818.

Code Lessons

A series of SIX half-hour tapes of code instruction is available as a public service of Tomlinson College Radio Club. Total cost is $1.00 for postage and handling.

This series is geared to the needs of the rank beginner. Letters are taught, and simple words formed on the first tape. Instructions are included with respect to buying theory books from your local store.

When they have *completed* the series, and *passed* the FCC license exam for Novice or Technician Class license, the club refunds deposits in full, except the $1.00 mentioned above.

For lesson number one, simply send name and address and $3.00 refundable deposit to Tomlinson College Radio Club, 3637 West Grandview, Tacoma, Wash. 98466.

FCC Radio Operator Test Schedule

Commercial radiotelephone examinations are now scheduled on tuesdays and fridays, 8:30 A.M. until 2:30 P.M. in Room 216 at the FCC Field Office, 1919 M Street, N.W. Washington D.C. Persons interested in taking the Commercial radio telegraph and amateur examinations involving code test may do so at 9:00 A.M. or 10:30 A.M. fridays only, at the same office. Examinations are not conducted on legal holidays.

A friend of ours dropped by the other day to talk to us about this rooftop problem.

About the only one down on our antennas these days is your friend and ours. But, what can we do? It seems you dig our antennas so much we can't stop making them. So, keep on buying them. And we'll see if we can't get the old guy to start using the front door.

Season's Greetings from Hy-Gain

Hy-Gain Electronics Corporation
P.O. Box 5407-FL, Lincoln, Nebraska 68501
The Strongest Signal Under the Sun

NEW Mobile Antenna System

VSWR GUARANTEE of 1.5/1 or better

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Designed for the economy-Minded Ham, the new "Rode-Master" offers a choice of 6. 10, 15, 20, 40, 75 &/or 80 meters. The upper telescoping Whip section doubles as a 6-meter antenna completely adjustable for the entire band. You select from five new precision wound 400 Watt Coils for 10, 15, 20, 40 and 75/80 meter operation.
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Bumper or trunk mounting option . . . Guying device for frequency stability at highway speeds . . . Break-over (hinge) to lower antenna . . . Rotate antenna 360° in the break-over position. A convenience for easy coil insertion, whip adjustments etc. . . . DX Matching Network: Small, simple to install and operate. The real reason why Mosley can Guarantee an adjustable VSWR of 1.5/1 or better.
Free QSO Index with the purchase of a complete "Rode-Master" antenna system. Get all the facts, See your Mosley dealer or write Dept. 206.

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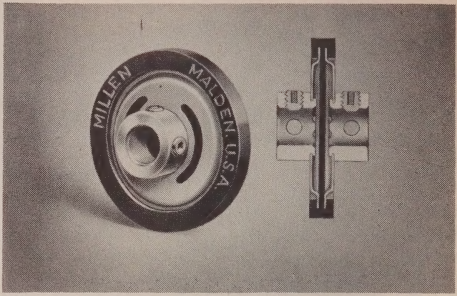
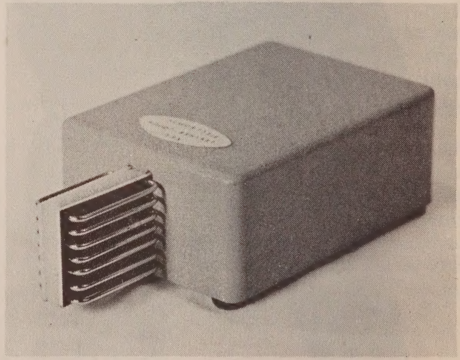
New Amateur Products



James Millen Mfg. Co.

The James Millen Mfg. Co., Inc. announces a new compact flexible coupling. The No. 39016 incorporates features which have been desired in a flexible coupling: No backlash, higher flexibility (can compensate for up to 10° misalignment), high breakdown voltage (conservatively rated at 4400 volts), and smaller size (1$\frac{3}{16}$″ dia. 9/16″ long). The standard No. 39016 is for 1/4″ shafts. Maximum torque rating 160 inch-ounces. The No. 39016-A is for 1/4″ to 3/16″ shafts. The No. 39016-E is for 1/4″ to 1/8″ shafts. For more information write to James Millen Mfg. Co., 150 Exchange St., Malden, Mass. 02148 or circle A on Reader Service coupon.



Data Engineering

Data Engineering announces their completely solid state electronic key. The Electronic Feather Touch Key is essentially an electronic single pole double throw switch activated by finger touch. Touching the electronic grid paddle causes a silicon monolithic integrated level detector to conduct. Conduction of each level detector causes an output transistor to remain at ground

INTRODUCING:

"THE DIGITAL 500" TRANSCEIVER

FROM

Robyn

SSB TRANSCEIVER DIGITAL 500
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Introductory Price **$895.00**
including matching speaker and AC power supply as shown. Optional DC Supply available.
PLEASE NOTE:
Effective Jan. 1972 price will be $1050.00 plus surtax.

SSB TRANSCEIVER DIGITAL 500

A new all band SSB/CW transceiver featuring digital frequency read-out and 500 W. PEP SSB input. This sophisticated hybrid transceiver uses 49 silicon transistors, 6 FET's, 42 diodes, 30 IC's and 6 tubes to provide smooth, high quality performance over all of the 3.5, 7.0, 14.0, 21.0 and 28.0 mHz bands. The Digital 500 measures only 13¼" x 7" x 12½" deep; power supply/speaker measures 6" x 7" x 12½".

FEATURING:

- Digital readout of frequency.
- .1 kHz readout.
- No calibration required.
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- Built-in Noise Blanker.
- Selectable AGC.
- High Sensitivity Schmidt-Trigger VOX.
- Stable Nixie display with latch circuitry and memory.
- External VFO can also be displayed.
- Built-in blower.
- CW Filter available as option.
- USB, LSB & CW operation.
- 80-10 meter, full band coverage.
- Better than 100 mHz stability after 30 min.
- 40 db carrier suppression.
- 50 db sideband suppression.
- 40 db harmonic suppression.
- 0.5 μv sensitivity for 10 db S+N/N.
- 2.4 kHz selectivity SSB, AM at -6 db; 4.2 kHz at -60 db.
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Sounds great! Rush me more information on the Robyn "Digital 500 Transceiver."

Name ____________________

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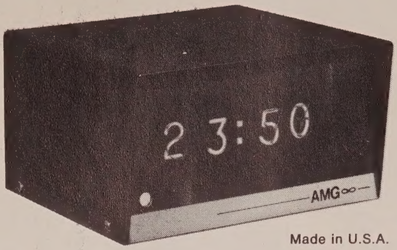
City __________ State ______ Zip __________

☐ I am a dealer; wish more information.

24 hour digital clock



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QUALITY

$99.00

- long-life bright red neon readout
- flashing bright red neon Station-Ident
- built-in rechargeable battery for short interval power failures
- standard metal cabinets in choice of black or gold
- optional wood cabinets in walnut or maple finish
- 12 hour version also available

specs **Accuracy:** based on the U.S. power grid 60 Hz standard of within 3 seconds per year. **Circuit:** TTL logic with conservatively rated components, 15 integrated circuits, 4 transistors, 7 diodes, fiberglass printed circuit board with 2 oz. copper. **Readout:** Neon tubes, rated 200,000 hour life (22+ years). **Station-Ident:** Neon light, flashes for a 30-second interval every 10 minutes as a station identification call reminder; disable switch provided. **Power requirements:** 117 volts 60 Hz, AC, 6 watts. **Size:** 5½" W x 3" H x 4½" D. **Weight:** 2½ lbs.

warranty Unconditionally guaranteed for one year on all parts and labor under normal use.

PLEASE SEND ME:
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☐ 24-hour clock with Station-Ident ($99.00)
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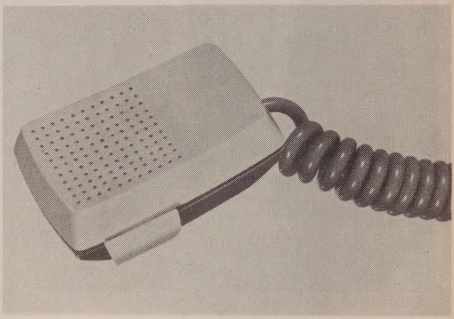
potential as long as a high impedence short (finger) remains across two adjacent grids. Erratic keying, due to either damp or dry fingers, has been eliminated by improved input circuitry and paddle design. The key sells for $19.95 ($22.95 with s.p.d.t. push-button switch). For complete information write to Data Engineering, Box 1245, Springfield, Virginia 22151 or circle B on the Reader Service coupon.



Turner

A new microphone has been announced by Turner. The Model M+3 features a slide-action control plus a compression amplifier to prevent over-modulation. The user can then set the volume up to 20 db gain over conventional microphones, speak close or far from the microphone without varying the output signal or transmitter modulation. The frequency response of the M+3 is rated at 300-3000 c.p.s. It has p.t.t. and a built in battery. The list price for the M+3 is $55.00. For more information write to: Turner, 909 17th St. N.E., Cedar Rapids, Iowa 52402 or circle C on the Reader Service coupon.

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This is an unusual offer, but the 600R and 600T are such unusual products that we feel you should have the opportunity to try them in your own shack at no risk, to convince yourself that the 600R and 600T are the finest amateur receiver and transmitter values you can own. You can order the units separately or as a pair, with or without accessories . . . any way you wish.

600R RECEIVER
SSB-CW-AM and FSK superheterodyne receiver. Covers 10 through 80 meters. **$395**

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With I.F. noise blanker, and IC audio filter factory installed. **$495**

600T TRANSMITTER
SSB-CW-AM self-contained transmitter with 600 watts P.E.P. input, 500 watts CW, 150 watts AM, and 100 watts continuous AFSK. Provides full coverage from 10 through 80 meters. **$535**

600S STANDARD SPEAKER
With tone switch and headphone jack. **$18**

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Includes Swan phone patch, tone switch, and headphone jack. **$ 59**

SS-16B Super selective filter . . . . add **$60**

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*Offer requires payment in advance for units desired. 15 day trial period begins upon your receipt of the units. If during the 15 day period you are dissatisfied with any of the units you ordered, return them to the factory, freight prepaid, and we will mail you a refund check for the full price of the units. Dealer participation in this program is optional. Offer expires December 31, 1971.

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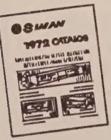

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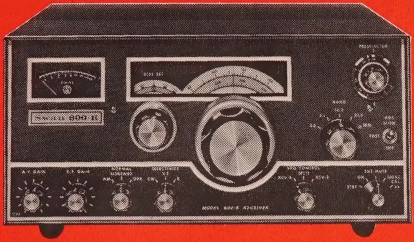

MODEL 600R

The perfect receiver for your ham shack, whether your interest is in phone, CW, DX, or rag chewing. With its tremendous sensitivity, selectivity, stability, and rugged construction, the 600R outperforms anything else on the market.

The 600R can be interconnected with its matching twin, the 600T Transmitter, or with a Swan 500C, 500CX, 270, or 270B Transceiver. The 600R will also operate with any other transmitter, requiring only antenna and muting connections.

MODEL 600T

600 WATTS, 10-80 METERS, SSB-AM-CW

A complete, self-contained, high power transmitter. When combined with the matching 600R Receiver, you'll have the finest and most versatile station available at any price. The 600T may also be used with any other receiver. All necessary muting and frequency spotting circuitry is included.

Special Features: Highly stabilized frequency control with ultra-smooth tuning system; the famous Swan high quality audio, single conversion design, producing fewer spurious byproducts.

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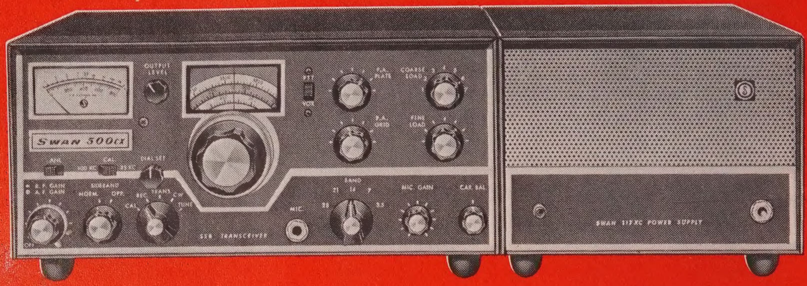
600R SPECIFICATIONS:

- SSB, CW, AM and FSK superheterodyne receiver
- Frequency range with built-in tuning system: 3.4 to 4.4 mc, 6.7 to 7.7 mc. 13.8 to 14.8 mc, 20.9 to 21.9 mc, 27.5 to 30 mc
- With external tuner, Model 330: general coverage from 3 to 30 mc
- Tuning system: 80 through 15 meters are covered by Bandspread Dial in 200 kc segments with 2 kc calibration. 10 meters is covered in 500 kc segments with 5 kc calibration
- With external oscillator, Model 510X: 3 to 24 mc, 10 crystal position. These external oscillators plug directly into the 600R
- Ultra-smooth vernier tuning, with large knob and dial, gives you the incomparable feel of a Swan tuning system
- Sensitivity: ¼ microvolt at 50 ohms for 10 db signal plus noise-to-noise ratio
- Selectivity: 2.7 kc bandwidth with 1.7 shape factor is standard
- Options include 0.6 kc CW filter, 6 kc AM filter, and SS-16B super selective filter
- Crystal calibrator with 25 and 100 kc selection
- Hybrid design: 7 tubes, 8 transistors, 12 diodes. Transistors used where they provide definite advantage. Tubes used where they still provide superior performance
- Features: Swan's exclusive single conversion design, with fewer spurious responses than multi-conversion designs
- Fully compatible with 600T Transmitter, providing transceive operation as well as separate frequency control. Also compatible with Swan 500C, 500CX, 270, and 270B Transceivers
- Both models have built-in AC power supply
- Dimensions: 15 in. wide, 6½ in. high, 12 in. deep. Weight: 23 lbs.

600T SPECIFICATIONS:

- Power rating: 600 watts P.E.P. input. 500 watts CW, 150 watts AM, 100 watts continuous AFSK
- Pi-network output for 50 or 75 ohm coax
- Frequency range: same as 600R. With Model 510X, the 600T may be crystal controlled for MARS and NET operation. 510X has 10 crystal positions and plugs directly into the 600T
- When interconnected with the 600R matching Receiver, the 600T VFO may be used for transceive operation, and may be calibrated with 600R crystal calibrator
- Solid state VFO, highest stability, temperature and voltage compensated
- Suppression: carrier 60 db, unwanted sideband 50 db (standard filter). Third order distortion approximately 30 db
- Audio response: plus or minus 3 db from 300 to 3000 cycles
- Includes built-in AC power supply
- Dimensions: 15 in. wide, 6½ in. wide, 12 in. deep. Weight 32 lbs.

THE MOST POPULAR TRANSCEIVER IN THE WORLD



SWAN 500CX

550 Watts — 5 Bands. SSB-CW-AM Transceiver

Because of its reputation for reliability and unsurpassed performance, the Swan 500CX has become the world's most popular transceiver. Not only is the 500CX the ideal rig for your ham shack, it also provides unparalleled high performance in mobile operation. The 500CX features single conversion which results in greatly reduced image and spurious response, made possible by the unique combination of a high frequency I.F. system and a highly stable multi-range variable frequency oscillator.

Sensitivity of the Swan receiver circuitry is second to none. Using the best vacuum tubes available for the R.F. amplifier, signal to noise ratios run as high as the state of the art permits, without the inherent overload problems found in solid state receivers.

Selectivity . . . Swan's 5.5 mc 2.7 kc bandwidth design produces the optimum shape factor, steepest skirts, and greatest ultimate rejection available. The result is maximum readability of voice under conditions of noise and QRM, making operating a pleasure.

Price, less power supply. . . . . **$489.**

SPECIAL FEATURES:

- 550 Watts P.E.P.
- Amplified automatic gain control circuit. Fast attack results in exceptional receiver control with no "pumping" effect.
- Built-in 25/100 kc solid state crystal calibrator.
- Sidetone oscillator for CW, pleasant sounding sine wave.
- Amplified Automatic Level Control for maximum "talk power" and less critical Mic Gain adjustment.
- Shifted carrier CW—eliminates "leap frogging" when operating CW.
- High stability solid state VFO.
- Single conversion design for fewer spurious responses.

GENERAL SPECIFICATIONS:

Frequency range: 3.5-4.0 mc, 7.0-7.45 mc, 14.0-14.45 mc, 21.0-21.45 mc, 28.0-29.7 mc. Extended frequency coverage for MARS operation with plug-in crystal oscillator accessory, Model 510X • 5.5 mc quartz crystal filter. Finest in the industry • 2700 cycle bandwidth, 1.7 to 1 shape factor at 6 and 60 db, more than 100 db ultimate rejection • Selectable upper and lower sideband • Solid state VFO, highest stability, temperature and voltage compensated • 13 vacuum tubes 7 transistors, 11 diodes.

TRANSMITTER SPECIFICATIONS:

Power rating: 550 watts P.E.P. input, 360 watts CW input, 125 watts AM input. Two 6LQ6 tubes • Suppression: unwanted sideband down more than 50 db, carrier down more than 60 db, third order distortion down approximately 30 db • Audio bandpass: 300 to 3000 cycles, ±3 db • Output circuit: wide range Pi, coarse and fine adjustment • Amplified ALC, increased voice power • Automatic voice controlled transmit with plug-in VX-2 accessory • CW keying, grid-block system, off-set transmit frequency • Semi-break-in CW operation with plug-in VX-2 accessory.

RECEIVER SPECIFICATIONS:

Sensitivity: requires less than 1/2 microvolt at 50 ohms for 10 db S + N/N ratio • Precision tuning: velvet-smooth dual ratio, zero backlash. The finest tuning system on the market • Audio fidelity: 300 to 3000 cycles, ±3 db • Amplified AGC, fast attack, no pumping, controlled decay • S-Meter circuit functions automatically in receive mode • Automatic noise limiter, with panel on-off switch • CW sidetone circuit for monitoring CW keying.

ACCESSORIES:

Model 117XC AC Power Supply	$ 99
Model 14-117 DC Power Supply	$129
Model VX-II Vox Unit	$ 35
Model 510X Crystal Control Unit	$ 49
Model 508 External VFO	$129
SS-16B Super Selective 16 Pole Filter, add	$ 60
I.F. Noise Blanker Accessory Kit	$ 89
IC Audio Filter for notching or peaking . .	$ 59
Model FP-1 Phone Patch	$ 44

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CQ 1971

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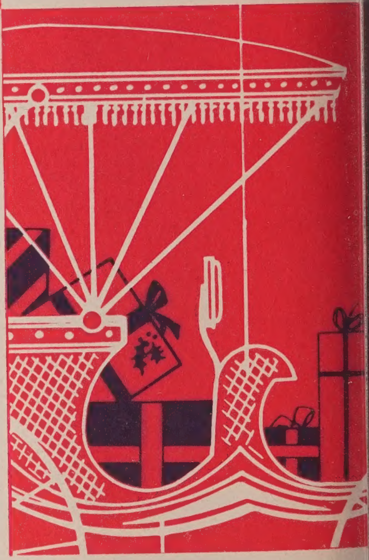

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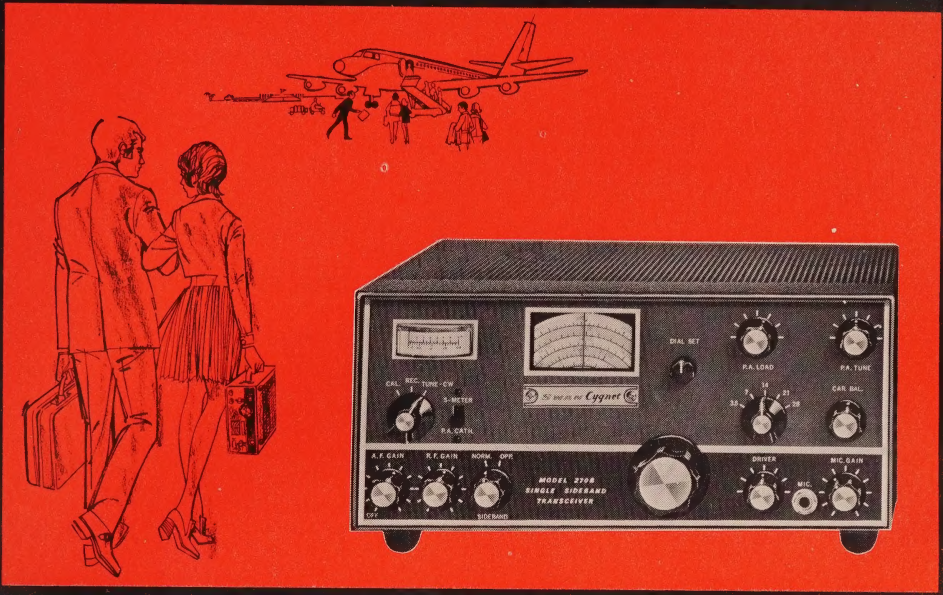
A complete station in one complete package.



SWAN CYGNET 270B

260 WATTS—5 BANDS—SSB TRANSCEIVER WITH BUILT-IN AC POWER SUPPLY AND LOUDSPEAKER

The lightweight, compact design of the Deluxe Cygnet makes it an ideal traveling companion. It contains all the features required for home station operation with enough power to work the world. Simply plug it in, connect an antenna, and you're on the air.

The Deluxe Cygnet also makes the perfect mobile rig. Simply attach the 14A DC Converter, connect to a 12 volt supply or cigarette lighter, and you're on the air. Perfect for traveler or vacationer. **$429**

SPECIFICATIONS:

• Power input: 260 watts P.E.P. SSB, and 180 watts CW • Frequency range: 3.5-4.0 mc, 7.0-7.3 mc, 14.0-14.35 mc, 21.0-21.45 mc, 28.0-29.7 mc • 5.5 mc Crystal Lattice Filter, same as used in the Swan 500CX. 2.7 kc with 1.7 to 1 shape factor. Ultimate rejection exceeds 100 db • Unwanted sideband suppressed 50 db. Carrier suppressed 60 db. Third order distortion down approximately 30 db • Audio response: flat within 3 db from 300 to 3000 cycles in both transmit and receive modes • Pi antenna coupler for 50 to 75 ohm coaxial cable • Grid block CW keying with offset transmit frequency • Solid state VFO circuit temperature and voltage stabilized • Receiver sensitivity better than 1/2 microvolt at 50 ohms for 10 db S + N/N ratio • 100 kc crystal calibrator and dial-set control • S-meter for receiver, P.A. cathode meter for transmitter tuning • Improved AGC and ALC circuit • Separate R.F. and A.F. gain controls • Sideband selector • Provision for plug in of VOX unit, external VFO, headphones, and Cygnet Linear • Tube complement: 12AU6 VFO amp., 12BE6 trans. mixer, 6GK6 driver, 6LQ6 pwr. amp., 6BZ6 rec. R.F., 12BE6 rec. mixer, 12BA6 1st I.F. amp., 12BA6 2nd I.F. amp., 12AX7 prod. det. A.F. amp., 6AQ5 A.F. output, 12AX7 mic. amp., 6JH8 bal. mod., 12AV6 AGC-ALC amp., 12BA6 xtal. cal. • Voltage input: 117 volts 50-60 cycles. Available on special order for 208-220-240 volts • For 12-14 volt DC operation, a plug-in converter, Model 14A, is available. This unit is only 1½ x 3 x 4 in., and plugs into the back of the 270B in place of the AC power connector • Dimensions: 5½ in. high, 13 in. wide, 11 deep • Net weight: 24 lbs.

ACCESSORIES:

Model 14A 12V DC Converter	$ 39
Model VX-II Vox Unit	$ 35
Model 510X Crystal Control Unit	$ 49
Model 508 External VFO	$129
Model FP-1 Phone Patch	$ 44
SS-16B Super Selective 16 Pole Filter, add	$ 60
I.F. Noise Blanker Accessory Kit	$ 89
IC Audio Filter for notching or peaking	$ 59

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NO COMPROMISE 2 METER PERFORMANCE

SWAN FM-2X
10 WATTS—12 CHANNELS

The low price of this exceptional 2 meter rig was achieved through Swan's Value Engineering. There was no compromise in performance, quality, or design. The FM-2X is without doubt the finest value in 2 meter transceivers on the market today. Its low price includes microphone, built-in speaker, AC and DC operation. Features include automatic protection of the output transistor, and individual trimmers on each transmit and receive crystal. Just compare the FM-2X with the others; you'll agree it's the best. **$259**

FM-2X SPECIFICATIONS:

• Frequency coverage 144-148 mc • Number of channels: 12 • Crystals installed for 3 channels as follows: Channel 1: transmit and receive 146.94 mc; Channel 2: transmit 146.34, receive 146.94 mc; Channel 3: transmit 146.34, receive 146.76 mc. Modulation: frequency modulation (phase type) • Transmitter control: push to talk on microphone • Power source: AC 117 volts, 50-60 Hz, DC 13.5 volts ±10% • Dimensions: 8¼" x 7" x 3". Weight: 8¼ lbs • Furnished with unit: dynamic microphone, antenna connector plug, spare fuses and lamps, AC power supply, DC power cord with fuse holder.

TRANSMITTER:

• Fully solid state • RF power output 10 watts nominal • Frequency deviation adjustable to ±15 kc; factory adjusted to approximately 5 kc • Frequency stability: ±.001% • Spurious radiation: —60 db below carrier • Frequency multiplication: 12 times.

RECEIVER:

• Circuitry: crystal controlled double conversion superheterodyne • Input impedance: 50 to 75 ohms • Intermediate frequencies: 10.7 mc and 455 kc • Sensitivity: 0.5 μv for 20 db quieting, 0.5 μv for 12 db Sinad • Intermodulation: more than 60 db down • Audio output: 1 watt to internal speaker.

VHF-150

150 WATT 2 METER AMPLIFIER
12 VOLTS DC—117 VOLTS AC

Here in one package is a complete 150 watt 2 meter amplifier, requiring only 2 watts drive to provide full 150 watts input. This amplifier will operate in class "C" for FM or CW, or in class "B" for SSB or other modes requiring linear operation. Designed for continuous operation. And by adding a 14C DC Converter you have a powerful mobile combination.

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VHF-150 with built-in 117 volt AC power supply **$279**

14C Converter **$65**

VHF-150 SPECIFICATIONS:

• Power rating: 180 watts P.E.P. input SSB; 150 watts DC input on CW or FM • Frequency range: 143-149mc • Uses 5894B twin tetrode • Drive requirements: approximately 2 watts for full output • Meter selector: reads plate current and relative output • Includes transmit and receive relay control for simple operation with a transceiver • Output coupling adjusted at factory for 50 ohms • Power supply: built-in 117 or 230 VAC input with proper line cord • Also DC operation with addition of 14C DC Converter • Dimensions: 13 in. wide, 5½ in. high, 10¾ in. deep • Weight: 23 lbs.

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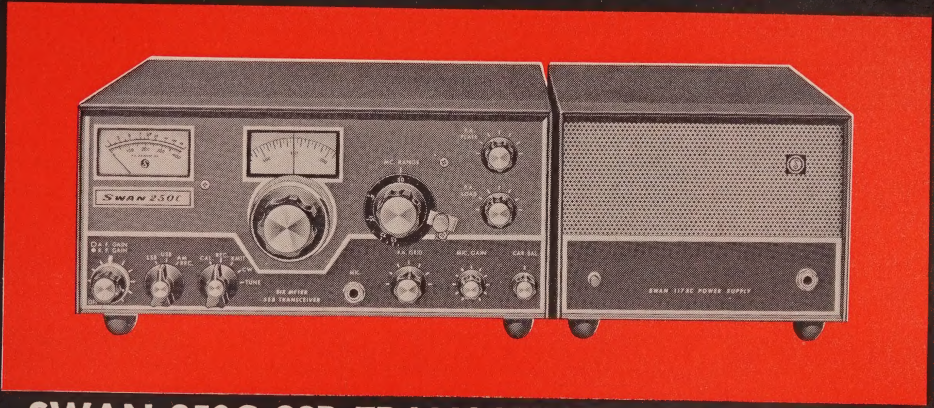
240 WATTS P.E.P. FOR VHF!



SWAN 250C SSB TRANSCEIVER FOR 6 METERS SSB-CW-AM—240 WATTS P.E.P.

The world's most popular SSB Transceiver for 6 Meters

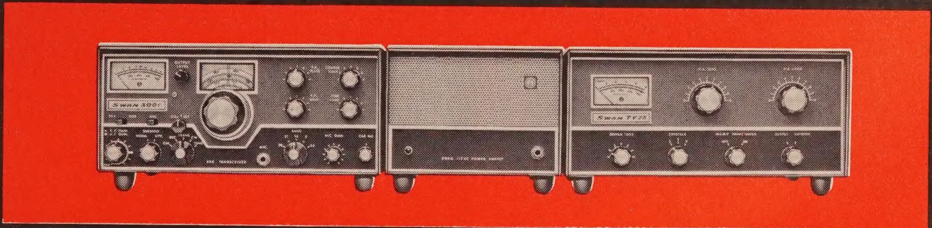
The same deluxe features that have made Swan HF equipment so popular have been designed into the 250C. Complete coverage from 50 to 54 mc with no crystals or extras to buy. Now there is practically no limit to the operating pleasure you can find in the 6 meter VHF band when your transceiver is the Swan 250C. **$429**

250C SPECIFICATIONS:

• Frequency range: 50-54 mHz • Power rating: 240 watts P.E.P. input in SSB mode, 180 watts CW input, 75 watts AM input • Two 6146B power output tubes • Suppression: unwanted sideband more than 40 db; carrier down more than 50 db; third order distortion approximately 30 db • Receiver noise figure: better than 3 db with two 6CW4 nuvistors in cascode • Selectivity: 2.8 kc at 6 db down, with 8 pole crystal lattice filter at 10.9 mc • Antenna matching: wide range Pi network • Metering circuits: S-meter on receive mode, P.A. Cathode Current and relative output in transmit mode • 250 kc crystal calibrator • Selectable upper and lower sideband • Solid state VFO, highest stability, temperature and voltage regulated • Audio passband: 300 to 3100 cycles in both transmit and receive modes • Receiver mode switch provides AM reception • Accessory sockets for noise silencer, external VFO and VOX unit • Dimensions: 5½ in. high, 13 in. wide, 11 in. deep. • Net weight: 16 lbs.

ACCESSORIES:

Model 117XC AC power supply	$ 99
Model 14-117 DC power supply	$129
Model 210 External VFO	$ 99



MODEL TV-2C TRANSVERTER

240 WATT SSB RECEIVING AND TRANSMITTING CONVERTER FOR 2 METERS

Designed to convert Swan transceivers for operation on the 2 meter band. Requires just one power supply for both the transceiver and transmitter. Provides 240 watts of power for working tropospheric and meteor scatter DX on 2 meters. **$329**

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SWAN LINEAR AMPLIFIERS

Maximum Power . . . Maximum Quality . . . Through Value Engineering

MARK II 2000 WATT LINEAR

The Mark II Amplifier provides your SSB, CW, or AM station the full legal power limit, with full frequency coverage of the amateur bands 10-80 meters, and also MARS frequencies. All controls are easily accessible on the front panel which allows you to tune the Mark II quickly and accurately.

The matching power supply is a separate unit which may be placed beside the Mark II or, with its 4½ foot connecting cable, on the floor. Component quality is of the highest caliber. Silicon rectifiers deliver 2500 volts DC in excess of 1.2 amperes. Computer grade electrolytic filters provide 40 mfd capacity for excellent dynamic regulation.

Mark II, complete with tubes and power supply **$599**

SPECIFICATIONS:
MARK II LINEAR AMPLIFIER

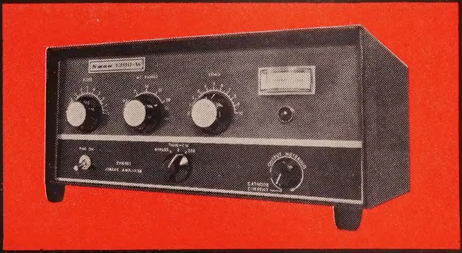
• Two Eimac 3-500Z zero bias triodes in grounded grid circuit • Conservative power ratings: 2000 watts P.E.P. input, 1000 watts CW, AM and RTTY input • Full frequency coverage of amateur bands 10-80 meters plus MARS frequencies • Wide range Pi network in output tank circuit • Drive requirements: 100 to 300 watts • Includes antenna changeover relay • Ceramic insulation on all tuning capacitors and RF switches • Planetary vernier drives on both plate and loading controls • Low RPM, high volume fan operates almost silently • Dimensions: 13 in. wide, 8 in. high, 14 in. deep • Weight: 20 lbs.

POWER SUPPLY SPECIFICATIONS:

• Input voltage may be either 117 or 230 volts AC, 50-60 ∿ (230 VAC operation recommended) • Silicon rectifiers deliver 2500 volts DC in excess of 1.2 amperes • Computer grade electrolytic filter capacitors. 40 mfd net capacity • Self-contained fan for cool, continuous operation • Dimensions: 9 in. wide, 8 in. high, 14 in. deep • Weight: 35 lbs.

MARK 6B 2000 WATT LINEAR FOR 6 METERS

Essentially the same as the Mark II, except that it provides coverage of the six meter band from 50-54 mc. Mark 6B, complete with tubes and power supply **$599**



MODEL 1200W

1200 WATT LINEAR AMPLIFIER, 10-80 METER COVERAGE WITH SELF-CONTAINED AC POWER SUPPLY

We built this as a matching linear for the Swan Cygnet 270B Transceiver, but with its low price, the 1200W has gained great popularity on its own. Utilizing a grounded grid super-cathode drive circuit, both efficiency and linearity are exceptionally high **$219**

SPECIFICATIONS:

• Power rating: 1200 watts P.E.P. input, 700 watts CW input, 300 watts AM input • Covers 10, 15, 20, 40 and 80 meters • Four 6LQ6 tubes operating as grounded grid triodes • Third order distortion down approximately 30 db • Pi output tank for 50 or 75 ohm coaxial antenna feed • Computer grade electrolytic filter capacitors • Silicon diode rectifiers • Complete with interconnecting cables, ready to plug into the 270B and operate, 117 volts, 50-60 ∿ input. Available on special order for 208-220-240 volts • Dimensions: 5½ in. high, 13 in. wide, 11 in. deep • Weight: 25 lbs. (Carrying handle included.)

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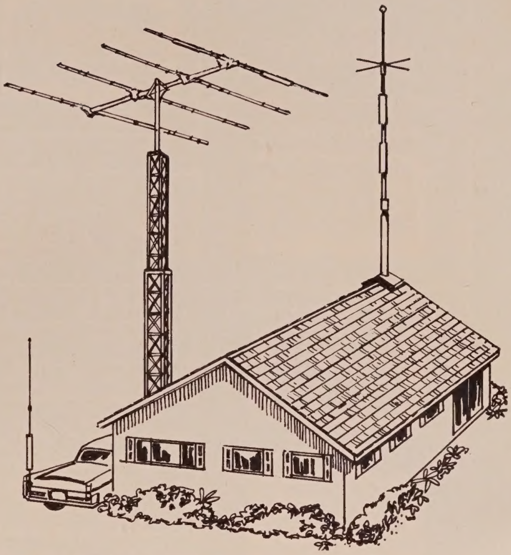
SWAN HIGH PERFORMANCE MULTI-BAND ANTENNAS

Swan has earned its high reputation in the ham radio market by offering top quality equipment with maximum performance and reliability at a most reasonable cost, backed up by the best customer service in the industry.

The Swan antennas of course include these same factors. Our antenna products are the best you can buy. The exclusive patented traps used in Swan antennas explain why they consistently give superior performance. Ask any ham who is using a Swan antenna, or better yet, check his signal on the air.

Impedance Match: Swan antennas are designed for a near perfect match on each band with 52 ohm coaxial cable. Standing wave ratio will be as low as 1.2 at band center, and only slightly higher at band edges, resulting in extremely low transmission line losses.



MODEL 1040-V HIGH PERFORMANCE TRAP VERTICAL

For 10, 15, 20 and 40 meters with optional 75 meters add-on-kit.

Model 1040V	**$49**
75 meter add-on-kit	**$29**

SPECIFICATIONS: SWAN TRIBAND BEAMS

All Swan Multiband Antennas are rated for 2000 watts, and require 52 ohm coaxial feedline.

*Heavy duty models.

	Forward Gain	Front to Back Ratio	Boom Length and Diameter	Longest Element	Turning Radius	Maximum Wind Survival	Wind Load @ 80 MPH	Wind Surface Area	Net Weight Assembled	Price
*TB-4H	9 db Average	24-26 db	24′ x 1½″	28′ 10″	18′ 6″	100 MPH	148 lbs	6 sq. ft.	54 lbs.	$129.00
*TB-3H	8 db Average	20-22 db	16′ x 1½″	28′ 2″	16′	100 MPH	110 lbs	4 sq. ft.	44 lbs.	$109.00
TB-3	7.5 db Average	20-22 db	14′ x 1½″	28′ 2″	14′ 11″	80 MPH	100 lbs	3.8 sq. ft.	39 lbs.	$ 94.00
TB-2	5 db Average	16-18 db	6½′ x 1½″	27′ 8″	14′ 3″	80 MPH	60 lbs	1.8 sq. ft.	18 lbs.	$ 79.00

HIGH Q—MAXIMUM PERFORMANCE MOBILE ANTENNAS

SINGLE BAND MODEL 35

Top section, 5 ft. whip	**$12.00**
15 meter coil	**$22.00**
20 meter coil	**$24.00**
40 meter coil	**$26.00**
75 meter coil	**$28.00**
18 inch base section	**$ 8.50**
36 inch base section	**$ 9.00**
48 inch base section	**$ 9.50**

5 BAND MANUAL SWITCHING MODEL 45

Covers 10, 15, 20, 40 and 75 meters with no coil changing. Gold plated contacts on the patented vertical switch provide 5 stops for full coverage of the 75 meter phone band. 1000 watts P.E.P. power rating. **$69**

5 BAND REMOTE CONTROL MODEL 55B

Our most deluxe model for the band hopping operator. Control box under the dash permits instant band changing while driving. The new control unit in the 55B stops automatically at the selected switch position. Covers 10, 15, 20, 40, and 75 meters with the same patented electrical and mechanical design as the manual Model 45, but with motor drive and remote control. 1000 watts P.E.P. **$99**

EXTRA KWIK-ON CONNECTORS for quick removal of Model 45 or 55	**$ 6**
Deluxe Bumper mount	**$24**

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RECEIVER	**600-R**		10-80 meters	**$395**
TRANSMITTER	**600-T**	600 watts	10-80 meters	**$535**
TRANSCEIVERS	**500-CX**	550 watts	10-80 meters	**$489**
	270B	260 watts	10-80 meters	**$429**
	250-C	240 watts	6 meters	**$429**
	160	400 watts	160 meters	**$429**
	FM-2X	10 watts	2 meters (FM)	**$259**
LINEAR AMPLIFIERS	**MARK-II**	2000 watts	10-80 meters	**$599**
	1200 W	1200 watts	10-80 meters	**$219**
	MARK 6B	2000 watts	6 meters	**$599**
	VHF-150	240 watts	2 meters	**$279**
ANTENNAS	Tri-band Beams		10-15-20 meters	
	Trap Vertical		10-80 meters	
	Mobile Antennas		Single and Multi-band	

PLUS MANY ACCESSORY ITEMS

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Tenth Anniversary of Amateur Space Communications

DECEMBER 12, 1971 will mark the tenth anniversary of amateur radio in space!

It was at 12:42 p.m. PST on that date in 1961 that the space era began for amateur radio, as a Thor-Agena rocket rose majestically from its Vandenberg, California launch pad, carrying a ten pound Oscar satellite aboard as ballast.

This was to become the first in a series of successfully-launched satellites to be built entirely by radio amateurs and other amateur space enthusiasts. Ten years and five Oscar satellites later the dream of a few has become a reality for all amateur radio.

CQ is proud to have played a major role in the Oscar satellite program right from the very beginning. It was, in fact, Don Stoner, W6TNS, writing in the April, 1959 issue of CQ who first raised the possibilities of an amateur satellite. It was also our own George Jacobs, W3ASK, working with the then newly formed Oscar Association who gave initial publicity to the project and who helped create the interest and enthusiasm that led to the successful launching of Oscar-1. George has played a similar role, through the pages of CQ, for each of the subsequent Oscar satellites launched successfully.

In recognition of his contributions in the field of space communications, the Secretary-General of the International Telecommunication Union invited W3ASK to prepare an article on radio amateur satellites for inclusion in a special issue (May, 1971) of the ITU Journal devoted entirely to space and published to mark the convening of the World Conference on Space Telecommunications held earlier this year in Geneva. Co-authored with Perry Klein, K3JTE, President of the Radio Amateur Satellite Corp. (AMSAT), the article is entitled Satellites In The Amateur Radio Service.

To mark the tenth anniversary of amateur radio in space, and because the article captures the true flavor of amateur radio, the editors of CQ are proud to re-print Satellites In The Amateur Service *on the following pages.*

Satellites in the Amateur Radio Service

BY GEORGE JACOBS,* W3ASK & DR. PERRY I. KLEIN,* K3JTE

THE very nature of amateur radio is such that right from its beginning more than 70 years ago, it has not only kept pace with the development of other radio services, *but it has often been well in the vanguard.*

The radio amateur has participated in the development of techniques which enabled radio waves first to reach "across town," then to connect cities, to link countries, to bridge oceans and to span the distance to the moon. It is not surprising, therefore, that the radio amateur should also be among the first to utilize space communications.

The successful launching of the first artificial earth satellite on October 4, 1957 fired the enthusiasm of radio amateurs throughout the world. Thousands of them dashed to their

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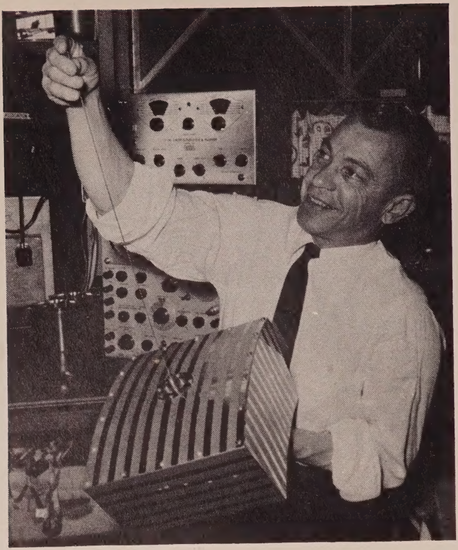
*Space Communications Editor, *CQ*.

†President, Radio Amateur Satellite Corp., c/o Amsat, P.O. Box 27, Washington, D.C. 20044.



Finishing touches being made to OSCAR I, the first in the series of amateur satellites. Launched successfully on December 12, 1961, the 2-meter telemetry-beacon transmitter aboard the satellite remained in operation for three weeks. Some 600 amateurs in 28 countries participated in tracking the satellite, and in propagation and other scientific studies.

receivers to listen to the 20 mc signal of SPUTNIK-*1*. It was very shortly thereafter that radio amateurs began to talk about constructing satellites of their own!

Project OSCAR

To carry this dream to reality, a group of radio amateurs, many of whom were professionally engaged as engineers and scientists in the space technology field, banded together in California during 1960 to form the Project Oscar Association. OSCAR is an acronym for *O*rbiting *S*atellites *C*arrying *A*mateur *R*adio. Their objective was to design and build satellites that would operate in the bands allocated to the amateur service, and that would permit radio amateurs everywhere to make useful contributions to the new field of space communications.

Working evenings, week-ends and during every spare moment in attics, basements and garages, the Project Oscar group completed their first satellite in about a year's time. The amateur radio service entered the space age on December 12, 1961, when the first Oscar satellite was successfully launched as ballast aboard a huge United States space vehicle. The satellite contained a simple 100 mw telemetry-beacon transmitter which operated continuously for about three weeks on 144.98 mc in the amateur 2-meter band. During this time, more than 5000 telemetry, beacon and tracking reports were received from 600 amateur radio stations located in 28 countries and on all continents, including Antarctica. Considering that only a small portion of the world's radio amateurs were equipped to receive 2-meter signals, this was a remarkable initial response.

Amateur radio's second satellite OSCAR-*2* was launched on June 2, 1962. Almost identical to OSCAR-*1*, *its* telemetry-beacon transmitter remained in continuous operation for 18 days on 144.99 mc. The response to the second Oscar satellite was even greater than the first. More than 6000 reception and tracking reports were received from 700 different amateur stations throughout the world.

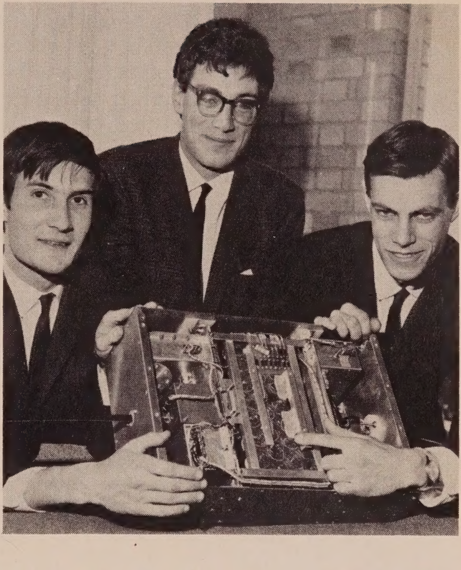
The first two OSCAR satellites were successful in introducing radio amateurs to space communications. Their telemetry-beacon signals provided useful propagation data as well as continuous observations of the satellite's behaviour. They also provided radio amateurs with basic satellite tracking experience, and paved the way for OSCAR-3, amateur radio's first active communications satellite.

Designed and constructed entirely by radio amateurs, the third satellite in the OSCAR series was successfully placed into orbit by the United States on March 9, 1965, again provided at no cost since the satellite filled extra space on a scheduled space vehicle launch. The satellite's 1 w. repeater received amateur signals over a small segment of the 2-meter band, increased their strength, and retransmitted them back to earth in another segment of the same band, but over far greater distances than would have been possible with the terrestrial stations alone.

Satellite History Made

OSCAR-3 made telecommunications history! By being launched a month *before* EARLY BIRD, the first International Telecommunications Satellite Consortium (INTELSAT) satellite, it holds the distinction of being the world's *first* free-access communications satellite. As proof of this, 100 amateur stations in 16 countries communicated through the OSCAR satellite during the two-week period that it remained in operation. The list of records established by OSCAR-3 is longer than space allows to be recorded here, but it provided the *first* direct communications via satellite for at least the following countries: Belgium, Bulgaria, Canada, Czechoslovakia, Finland, Israel, Sweden and Switzerland. In addition, radio amateurs in the United States, the Soviet Union, Germany, Spain, France and the United Kingdom also communicated through the satellite. The Atlantic Ocean was bridged at least twice through the satellite, when station *DL3YBA* in Germany communicated with *W1BU* in the United States and *EA4AO* in Spain contacted *W2AZL* in the United States.

On December 21, 1965 amateur radio's fourth satellite was launched. Called OSCAR-*4,* it was designed as an active communications satellite with an up-link in the 144 mc, or 2-meter band and a downlink in the 432 mc, or 70-centimeter band. While the 3 w. repeater aboard the satellite functioned, the desired orbit was not achieved, and only a dozen or so two-way contacts were established through the satellite. Nevertheless, OSCAR-4 did establish at least one communication record, when on December 22, 1965 *K2GUN* contacted station *UP2ON*, for the *first* direct communication via satellite between the United States and the Soviet Union!



A look inside the fifth and most recent satellite launched in the OSCAR series. Designed and constructed in Australia by students at Melbourne University (three of whom are shown), this was the first amateur satellite to be ground-controlled. Hundreds of amateurs throughout the world used the satellite's 10 and 2 meter telemetry beacons for tracking, propagation and other studies during early 1970.

Australis-OSCAR

Demonstrating the world-wide nature of this undertaking, the fifth satellite in the amateur radio service was designed and constructed by students at Melbourne University in Australia, under the auspices of the Wireless Institute of Australia. The satellite was prepared and qualified for launch by the Radio Amateur Satellite Corporation (AMSAT), a Washington, D.C. based international organization of radio amateurs having members from at least 25 countries.[1]

The United States National Aeronautics and space Administration (NASA) launched the AUSTRALIS-OSCAR-5 *(AO-5)* satellite on January 23, 1970 as a secondary payload on the ITOS-*1* weather satellite mission. The amateur satellite carried two telemetry-beacon transmitters, one operating continuously on 144.05 mc in the 2-meter band and the other *on command* on 29.450 mc in the amateur 10-meter band.

The satellite's electronic system operated for about a month and a half, and terminated with the depletion of the onboard chemical batteries. Although it carried beacon transmitters rather than a communications repeater, AO-5 provided an excellent opportunity to test several important concepts new to satellites in the amateur service.

Perhaps most significant was the command-control system which made it possible to turn the 10-meter transmitter on and off from the ground on a regular, prearranged schedule. This demonstrates that emissions from amateur satellites can be controlled in the event interference develops, thus greatly enhancing the practicality of operating amateur satellites in those bands shared between the amateur and other services.

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[1] AMSAT wa formed in 1969 to continue the work of Project OSCAR. The purpose of AMSAT is to foster world-wide participation in amateur space experiments, and, in so doing, bring about improved communications for the amateur and other services alike. Membership is open to radio amateurs of all countries and to others interested in amateur space experiments. AMSAT is affiliated and receives support from the American Radio Relay League Further information can be obtained from AMSAT, P.O. Box 27, Washington, D.C. 20044.

The AO-5 mission was technologically successful in several important respects. A unique, but simple system consisting of a bar magnet and eddy current damper helped stabilize the satellite, and kept it aligned along the magnetic field lines of the earth, much as a compass aligns itself with the earth's poles. This kept satellite spin and subsequent signal fading to a minimum. A seven channel audio tone analog telemetry system constantly monitored the satellite's alignment, temperature, and power supply performance. The system was so designed that the data could be decoded simply with inexpensive equipment usually found at amateur radio stations.

AO-5 was the first amateur satellite to transmit in the h.f. as well as v.h.f. range, permitting propagation studies to be made at two distinctly different frequency ranges. A significant number of propagation anomolies were reported, such as over-the-horizon and antipodal reception and certain auroral phenomena.

Another major success of the AO-5 mission was the interest and enthusiasm it generated throughout the world. Reception, tracking and telemetry reports were received from several hundred amateur radio stations in at least 27 countries.

Future Amateur Satellites

Groups of radio amateurs on at least three continents are actively engaged at present on the design and construction of various systems and components for furture OSCAR satellites, and plans are also under way for a repeater which it is hoped some day may be placed on the surface of the moon!

The OSCAR IV satellite undergoes final assembly by some of its amateur builders. OSCAR IV received signals on the 2-meter band and retransmitted them on the 420 mc band after amplification.

A four-channel hard-limiting f.m. repeater is being assembled in Australia by the same group of amateurs responsible for the AUSTRALIS-OSCAR-5 satellite. This repeater will receive and demodulate amateur signals from a segment of the 144 mc or 2-meter band, and remodulate and retransmit them in a segment of the 432 mc or 70-centimeter band, with a transmitter output of 1 w. per channel.

A EURO-OSCAR repeater, a project initiated under the auspices of Region 1 of the International Amateur Radio Union (IARU) is nearing completion in Germany. This will be a 10 w. linear repeater with a bandwidth of approximately 50 kc. It will be capable of receiving signals in the amateur 70-centimeter band, centered on a frequency of approximately 432.1 mc and relay them in the 2-meter band, at a center frequency of approximately 145.9 mc. Since the 70-centimeter band is shared between the amateur and radio-location services, a pulse blanker has been incorporated in the design to suppress wide-band pulsed radar interference in the up-link circuit. The repeater is designed for use with single sideband, c.w., f.m. Teletype and amateur television transmissions.

Another linear repeater is nearing completion in the United States. Being constructed by AMSAT, this 2 w. repeater will have the capability of receiving signals in a segment of the 2-meter band, centered on 145.9 mc and relay them in the 10-meter band, centered on approximately 29.5 mc.

In the United Kingdom a group of radio amateurs are working on Project TRIDENT, which has proposed to construct a 3 w. linear repeater with an up-link in the 2-meter band and a down-link in the 70-centimeter band. Groups of amateurs in Australia and the United States are also developing simplified telemetry systems designed to send information on satellite performance in teletype format, or directly in Morse code, to reduce the effort required to decode such information at amateur earth stations.

Other groups of radio amateurs around the world are busy constructing solar rechargeable power supplies, command-control systems, antennas, and the myriad of other circuitry and sub-systems required for the operation of communications satellites.

The next OSCAR satellite is expected to be launched by early 1972, and will consist of some of this equipment now under construction throughout the world.

Another somewhat ambitious space communications project has been undertaken by radio amateurs. Called Project *Moonray* (from *Moon* amateur *Relay*), it is hoped that a linear repeater designed and built by amateurs may some day be placed into operation and left on the surface of the moon. Tentative plans call for the design of a 5 w. repeater, capable of receving signals in a portion of the 70-centimeter band and relaying them throughout the world in this or in another u.h.f. band allocated to the amateur service.

Interference and Frequencies

The amateur service, perhaps more so than any other radio service, is feeling the pinch caused by the congestion in the h.f. bands. Relative to other services, the number of stations operating per kilocycle in the amateur bands is exceptionally high. To make efficient operation possible under such conditions, over the years the amateur service has continually exploited technical developments stressing the use of narrow-band emission techniques, reductions in receiver bandwidths, use of directional antennas and transferral of operation to the v.h.f. and u.h.f. bands wherever this is technically possible. This same philosophy is being carried forward by radio amateurs in the space age.

Not a single case of harmful interference is known to have been reported from the operation of the five amateur satellites launched to date.

Future amateur satellites are planned that will use each of the h.f. bands allocated to the amateur service for propagation research and for extending the use of these bands for communications purposes during periods when ionospheric conditions will not permit their use by terrestrial stations. Each of the v.h.f. bands will be used for communications, tracking, telemetry and research. The u.h.f. bands will be used mainly for communication purposes and moon relay systems.

In each of the bands assigned *exclusively* to the amateur service, radio amateurs will continue their traditional policy of self-imposing operator disciplinary measures to avoid interference between the transmissions of amateur satellites and terrestrial amateur stations.

In each of the bands *shared* between the amateur and other services, future amateur satellites will contain command systems which will enable control of spacecraft transmissions in the event that harmful interference occurs or is likely to occur. They will also contain blanking, filters and other circuitry to reduce the possibility of satellite interference to and from other terrestrial services.

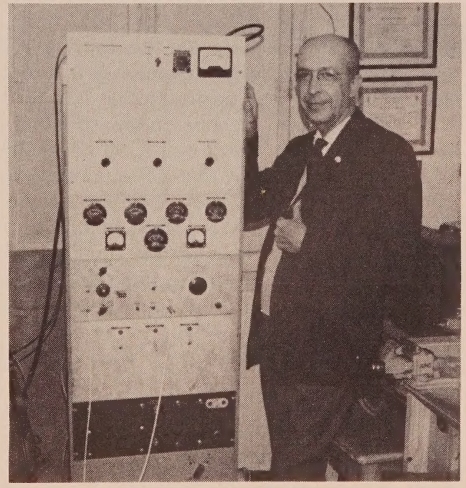
Radio amateurs are confident, based on their long history of handling interference and the experienced gained from the first five amateur satellites, that terrestrial stations in the amateur and other services can operate harmoniously with amateur satellites, on an interference-free basis.

Benefits From Amateur Satellites

The benefits derived from amateur satellites go far beyond the amateur service itself. Amateur radio, with the world as its classroom, has always served as a successful training technique for the entire field of electronics. Now, amateur satellites have extended this classroom into space as well. What better way is there to gain experience with space communications than by participating actively in it?

From the ranks of amateur radio over the years have come large numbers of trained technicians, operators and instructors. Many of the world's leading telecommunication engineers and officials trace their first interest in their profession to participation in amateur

[*Continued on page 87*]



Two-meter equipment used by Jesus Martin Cordova, EA4AO, to establish direct 2-way communications between Spain and the U.S. through OSCAR III during March 1965.

The Motorola 80D on 220 mc F.M.

Part III—Antennas

BY BYRON H. KRETZMAN,* W2JTP

PART I of this series of three articles about f.m. operation on the 220 to 225 mc band described the modification of a high-band 30-watt transmitter from the Motorola -80D equipment. Part II detailed the conversion of the high-band "G" receiver strip to 220/225 f.m. Now we will describe two easy-to-build vertically polarized 220/225 antennas suitable for general operation on this band.

Why Vertical

Remembering the history of f.m. on 6 and 2 meters, it follows that vertical polarization is a must for *general* operation on 220-225 mc. (We are *not* talking about the use of 220/225 for point-to-point control links for repeaters.) This is logical, for the same reasons that operation on the high end of the 220/225 band is suggested; that is, the fact that most a.m. and DX operators are on the low end, and *they* are using horizontal antennas. For general f.m. operation, considering the lack of crowding on the high end, omnidirectional vertical antennas are more practical. Furthermore, they are real easy to build; and, looking to the future, mobile 220/225 f.m. with a vertical antenna on the car is likewise logical. The trump card, winning for vertical polarization, is that TV antennas are horizontal. When we use vertical antennas the possibility of TVI is greatly reduced. It works the other way around, too. Image interference *from* TV stations to our receivers is drastically reduced when our antenna is vertical.

The Ground Plane

Construction of a ground plane antenna for the 220-225 mc band is is simplicity, itself. The photograph should be sufficient; however, fig. 1 details an L-shaped mounting bracket. A coax chassis connector, an SO-239, is mounted on the bracket which can fasten to a length of TV mast via the two U-bolts shown. The length in inches of the quarter wavelength radials and the vertical radiator is figured by dividing 2770 by the operating frequency in mc. For 224.95 mc this comes out to 12⁵⁄₁₆". The material used was #18 copperweld electric fence wire. Put a small loop on each end to prevent injury to anyone while handling. The four radials are fastened under the four screws that mount the connector to the bracket. The radials should be bent down at roughly a 45 degree angle. A UG-106/U hood was used underneath to mate the coax to the connector.

The vertical radiator was soldered into a pin plug, one of two removed from the -80D dynamotor. The cap from a PL-259 can be used with a short length of plastic tubing to

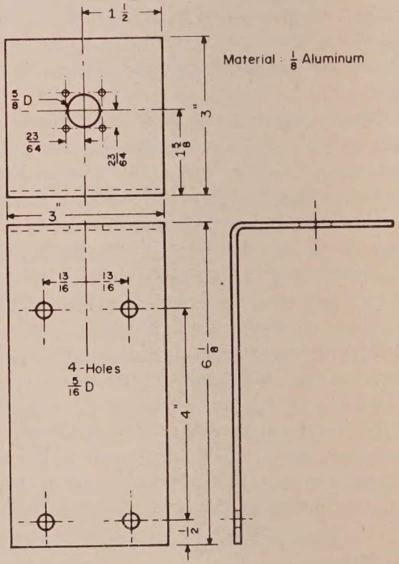


Fig. 1—Ground plane mounting bracket, mechanical details.

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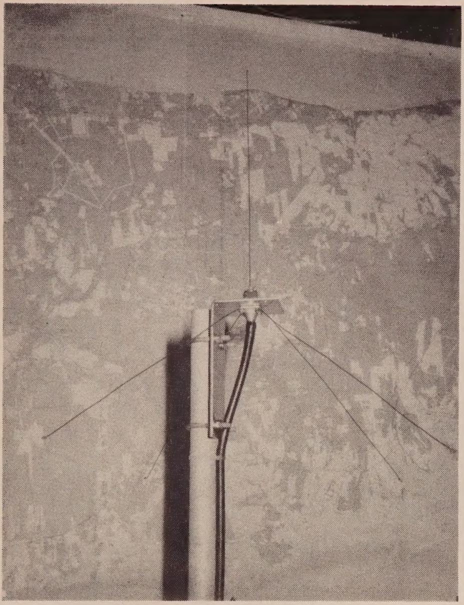
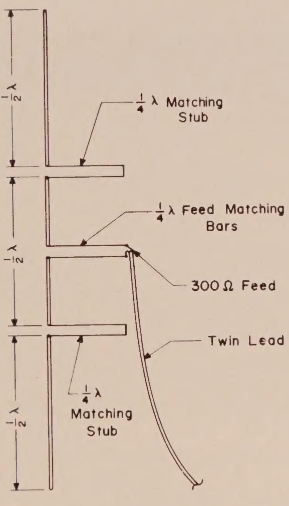
*431 Woodbury Road, Huntington, N.Y.



The ground plane antenna for 224.95 mc f.m. Drooping the radials reduced the v.s.w.r. to 1.1 to 1 at the design frequency. No other special matching was needed.

fit around the pin plug after it is inserted into the SO-239. The whole connector, both the top and inside the hood underneath, should be filled with silicone compound, such as Amphenol 53-307 or Motorola 11T834678. The idea is to keep out water.



$\frac{1}{2}\lambda$
$\frac{1}{4}\lambda$ Matching Stub
$\frac{1}{2}\lambda$
$\frac{1}{4}\lambda$ Feed Matching Bars
300 Ω Feed
Twin Lead
$\frac{1}{2}\lambda$
$\frac{1}{4}\lambda$ Matching Stub

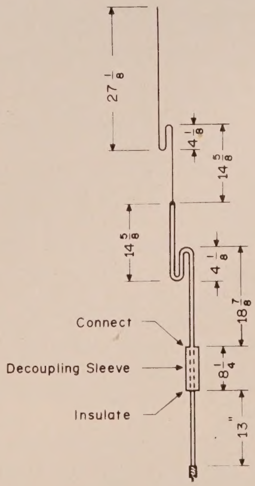
Fig. 2—Franklin antenna, or three half waves in phase.

A Gain Antenna

Gain in an omnidirectional antenna is obtained by vertical stacking of half wave elements. In the early days of ham v.h.f. the Franklin antenna was very popular, and very effective. Figure 2 shows three half wave elements stacked in this configuration. Building such an antenna is not easy. The quarter wave stubs can be bent into loops, but the feed should be brought out at a right angle to the antenna, kind of hard to do. Such a structure is inherently fragile, too.

There *is* a better way to build this type of gain antenna, keeping the three half waves in phase for a gain in the order of 4 db. The Harris development[1] of the Franklin antenna neatly solves the electrical problem of feeding this array in the center by using coaxial cable for the lower half since coax can be readily formed into folded stubs. Figure 3 diagrams this antenna for 224.95 mc. (The lengths are figured from the ARRL *Handbook* formula where a half wavelength in inches is equal to 5540 divided by the frequency in mc.)

The top half of our 224.95 mc gain antenna is shown thinner than the bottom half only for the sake of clarity; both halves are made from RG-58/U. A piece of close-woven copper braid was used as a decoupling sleeve. (No ground radials are necessary with this antenna.) The braid was soldered to the



27 1/8
4 1/8
14 5/8
14 5/8
4 1/8
18 7/8
Connect
Decoupling Sleeve
8 1/4
Insulate
13"

Fig. 3—220/225 mc gain antenna details.

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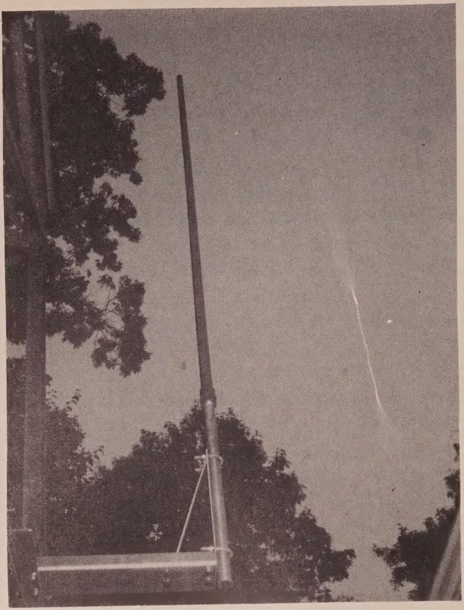
[1] Harris, E. F., "UHF Mobile Antenna," *Electronics,* May 1953, P. 181.



The 220/225 gain antenna in the air. Its length is 7 feet plus 18″ for the aluminum mounting pipe. Note the absence of ground plane radials—none are needed.

coax at the point labeled *connect* in fig. 3. At first we simply ran the braid over the outer vinyl covering of the RG-58/U. A gradual increase in v.s.w.r. was traced to heating at the insulated end of the decoupling sleeve. The solution was to strip off the vinyl outer covering of the RG-58/U at the sleeve position and substitute a short piece of teflon tubing for the required insulation.

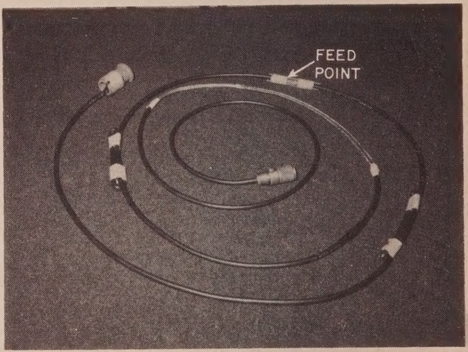
Construction of the Gain Antenna

Commercial gain antennas of this type are usually enclosed within the protective covering of a fiberglas tube. This material is sometimes available, in the form of fish poles or outriggers, near boat yards, but even in this form it is fairly expensive. A much more economical approach is to use plastic "PVC" pipe. This can be obtained from plumbing suppliers, or Montgomery-Ward and Sears-Roebuck, for around one or two dollars for a ten foot length. We used the standard 3/4″ (ID) pipe size, also purchasing the special cleaner and PVC cement used to mate this kind of pipe.

We cut a seven foot length of the 3/4″ PVC pipe and cemented it into a PVC adaptor to a 3/4″ female pipe thread. This permits the antenna to be mounted on the end of a short piece of standard metal pipe. Aluminum thick-walled pipe or conduit is recommended since it is much lighter than iron pipe, and it doesn't rust. A piece of lacing twine was used to anchor the top of the antenna to a PVC plug at the top, cementing in the plug.

You can make a really waterproof assembly by pouring into the pipe (after the antenna is in, of course!) expandable polyurethane foam. Be *sure* that the bottom end is plugged with caulking compound, otherwise the solution will run right out before foaming. Polyurethane foam in liquid form, which must be mixed, is available in most well stocked hobby stores as it is used frequently in model airplane building.

While the gain antenna itself is made from RG-58/U, it *not* recommended that RG-58/U be used for the transmission line run. Reason? RG-58/U loss is about 6.5 db per 100 feet at 225 mc. RG-8/U has a loss of a little over 3 db at this frequency. And there are several varieties of a foam dielectric "RG-8" available. These have even less loss than the RG-8/U. In particular we suggest using the type T4-50 made by Times Wire and Cable. Be sure to use the silicone compound previously mentioned in the connector at the bottom of the antenna when you go to the better transmission line. And, of course, tape this connector junction with a good all-weather vinyl electrical tape such as the Scotch #88T. ■



This is what is inside the 220/225 gain antenna. Made from RG-58/U, it is shown coiled up to simplify photography. Observe the mechanical strengthening at the feed point by means of a couple of strips of PC board material. Also, more of the vinyl outer covering below the decoupling sleeve was removed than was necessary.

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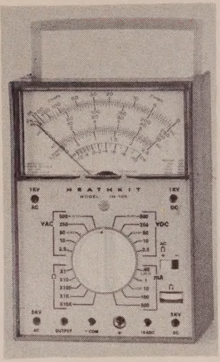
CQ Reviews: The Heath IM-105 V.O.M.

BY WILFRED M. SCHERER,* W2AEF



Besides being a handy and accurate piece of test gear for a wide variety of applications, the Heath Model IM-105 v.o.m. incorporates a number of unusual features that should make it of special interest.

The instrument employs a ruggedized American-made Weston meter that has a taut-band movement. The meter is thus less susceptible to shock damage and it has low friction that eliminates sticky operation and provides excellent repeatability of readings. It also has fine linearity, while good resolution is obtained by means of a large size meter scale with a 95-degree viewing area.

The meter is protected against overload damage by the installation of back-to-back diodes shunted across it plus an in-line fuse at the main-input jack. The fuse also offers a measure of protection to the other components. It is removable from the front of the panel.

The instrument is contained in a high impact-strength Lexan case. This material is a form of plastic that has some "give" to it, making it less subject to breakage or cracking than with older type instruments built into a "molded-mud" type of case. The carrying handle may be retracted into the case, and thus be kept out of the way for convenient storage of the unit.

The IM-105 is a 20,000 ohms-per-volt job on the d.c.-voltage ranges for which the basic accuracy is ±3% of full-scale; and 5000 ohms-per-volt on the a.c.-voltage ranges with an accuracy of ±4%. The d.c.- and a.c.-voltage ranges are 0-2.5, 10, 50, 250, 500, 1000 and 5000 volts. There is an additional d.c. range of 0-0.25 volts. A polarity-reversing switch is included for d.c. operation. On a.c. the input capacitance is rated at less than 20 mmf, while the frequency response (from a low-impedance source) is rated as ±5% up to 50 kc on the 250- and 500-volt ranges and up to 100 kc on the lower ranges. An a.c.-output position is included for isolation at circuits where there is a d.c. potential present. The low-frequency response on the lower ranges drops off slightly in this position.

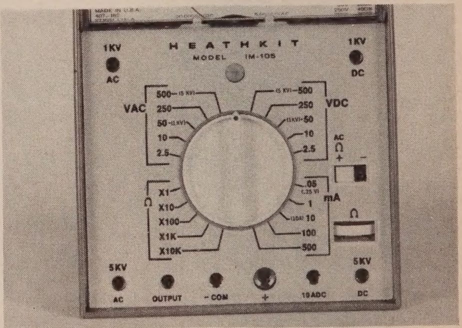
There are six direct-current ranges, namely: 0-50 μa with ±2% F.S. accuracy; 0-1, 10, 100, 500 ma and 0-10 a., all with ±3% F.S. accuracy.

A different v.o.m. setup involves the resistance ranges of which there are five instead of the customary three. These are × 1, × 10, × 100, × 1000 and × 10,000 with a center-scale factor of near 20. This provides conveniently obtainable readings at intermediate values that are not as well realized with other v.o.m.'s. Measurements of 0.5 ohms to 20 megohms may be made. The accuracy is rated as ±3% of arc which also is indicative of the meter linearity.

Metal-film resistors with a one-percent tolerance are employed and overall accuracy is maintained over a wide temperature range with compensation by a thermistor.

Construction

The uniqueness of the IM-105 is carried on to its method of construction. The meter



Closeup view of the panel for the IM-105. The meter is off or inoperative when the selector knob is set at one of the four positions between the function ranges.

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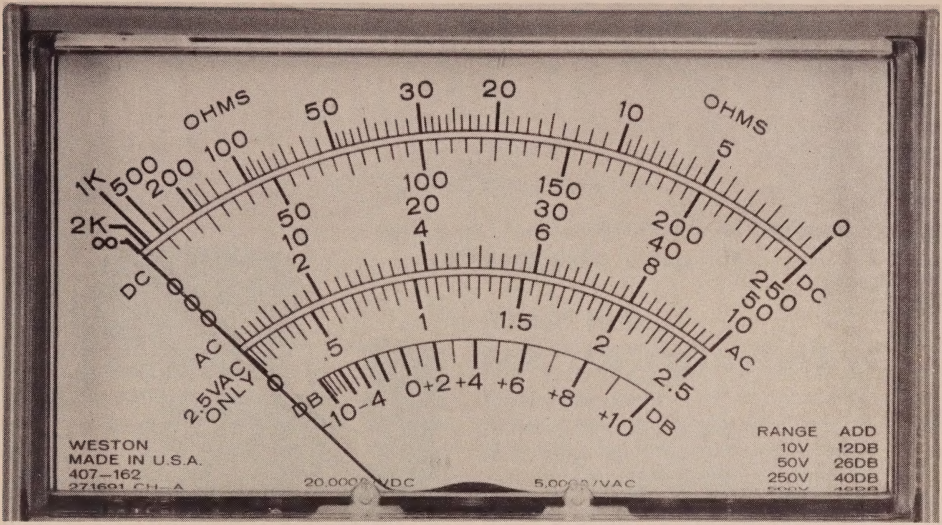
*Technical Director, *CQ*.



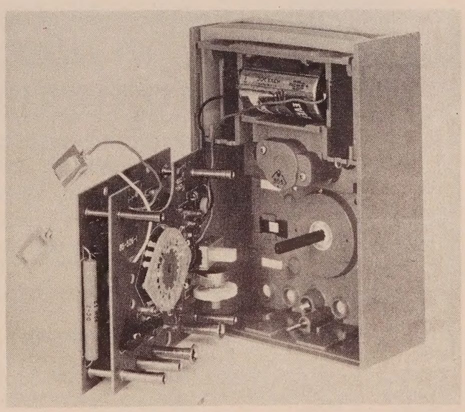
Meter scale used in the Heath IM-105 V.O.M.

movement, the meter scale and the front panel are built right into the instrument case and thus are supplied as one integral unit. The circuit components are otherwise assembled by the customer on two printed-circuit boards which are held parallel to each other by metal supports that serve as interconnections between the boards. Some of these supports are hollowed at one end where they are accessible at the front panel where they act as input jacks for some functions. Similar jack-type posts extend from the front board to the panel for other functions. One of these, the jack for the positive test lead, holds an in-line fuse. This element may be screwed out using one end of a knurled thumb-screw that holds the rear cover for the case. This cover simply slides into grooves in the case, making easy accessibility to the interior of the case without the removal of the four screws usually found. Only the one locking screw need be loosened.

The OHMS-ADJUST control is a thumbwheel type which along with the polarity-reversing switch mounts on the front circuit board and projects through the panel. Switch-deck terminals are soldered directly to the circuit boards as are the multiplier and shunt resistors. You don't have to wire in resistors at switch decks as is usually necessary.

The switch knob and detent are part of the panel assembly on the case and when the sub-assembly comprised of the circuit boards is installed in the case, the shaft from the switch knob slides through the movable wafers of the switch decks. The only extra wiring needed goes to clips for the batteries that slide into recessed compartments in the case. A 1.5-volt D cell and a 15-volt (NEDA #208) battery are required.[1] The unit can be assembled in 3-4 hours. The size of the instru-

[*Continued on page 92*]



Interior view of the IM-105 showing the method of assembly as described in the text. The support or interconnecting posts that serve as input jacks at the panel are along the bottom edge and at the four corners of the front circuit board. The parts dangling from the wire leads at the left are the clips for the 15-volt battery, all of which slide into the compartment at the upper right.

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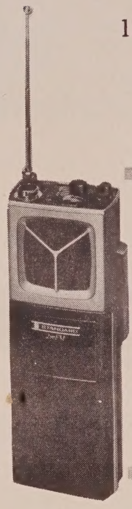

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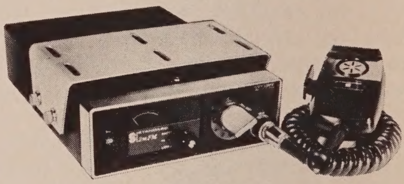

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Sideband With The Ranger

BY FRED BROWN,* W6HPH

An easy conversion of a very popular transmitter gives 100 watts PEP of d.s.b. on 160 through 10 meters.

MORE Viking Rangers were sold than almost any commercial all-band transmitter in amateur history. This very flexible and versatile rig was designed for a.m. and c.w. operation—the popular modes during the 1950's when the Ranger was first introduced. It still makes a first-rate all-band c.w. transmitter; but to show up on our phone bands with Ancient Modulation in these days of universal s.s.b. would be tantamount to driving down 5th Avenue with a horse-and-buggy.

Here are the details of a simple no-holes (almost) modification that puts the Ranger on double sideband (d.s.b.) and lets you join the s.s.b. gang without being condemned as backwards and out-of-tune with the times.

Why D.S.B.?

Before you turn up your nose at d.s.b. consider some of the advantages:

1. The main advantage, of course, is simplicity. Conversion of an existing a.m. rig to s.s.b. is almost as hard as building an s.s.b. rig from scratch, whereas conversion to d.s.b. usually involves only minor circuit changes.

2. At the receiver end, d.s.b. is indistinguishable from s.s.b. unless the operator switches to the other sideband. More than 90% of the stations worked with this rig had no idea it was on d.s.b. until they were told.

3. Many of the experts claim that d.s.b. is actually superior to s.s.b. in communication effectiveness. See, for instance, the very scholarly paper by John Costas in the *IRE Proceedings*.[1]

4. The criticism usually made of d.s.b. is that it takes up twice as much spectrum as s.s.b. This is undeniably true in the idealized case but in actuality s.s.b. is single in name only. That unused sideband is occupied by distortion products which are typically down only 25 to 35 db below the desired sideband. Distortion products of a somewhat overdriven 2 kw "linear" are not many db below the level of a low-power d.s.b. signal.

5. The 3 db of power lost in the unused sideband can more than be made up by the use of speech clipping which works with d.s.b. but not s.s.b. With d.s.b. the receiving operator also has the advantage of selecting whichever sideband is most readable at a given moment—an enormous advantage in QRM, or in cases of selective QSB.

The Balanced Modulator

To convert an existing a.m. rig to d.s.b. it is merely necessary to substitute a balanced modulator for the old a.m. final. The v.f.o. and driver circuits can remain unchanged. A simplified balanced modulator circuit, of the type suitable for use as a d.s.b. final is shown in fig. 1. Two tetrodes are needed, the grids are driven with push-pull r.f., and the plates are connected in parallel. The screen grids must then be driven by push-pull audio modulating voltage, unlike plate-modulated a.m.,

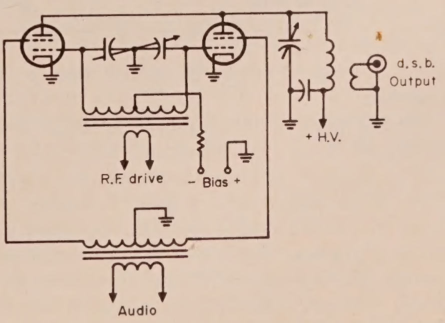

Fig. 1—Simplified circuit of a dual-tetrode balanced modulator. Used as a final amplifier both tubes operate class-C and can produce higher peak efficiency than can be obtained from a linear amplifier.

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*73 Regent St., Cambridge, England.

[1] "Poisson, Shannon, and the Radio Amateur," *Proceedings of the IRE*, Dec. 1959, page 2058.

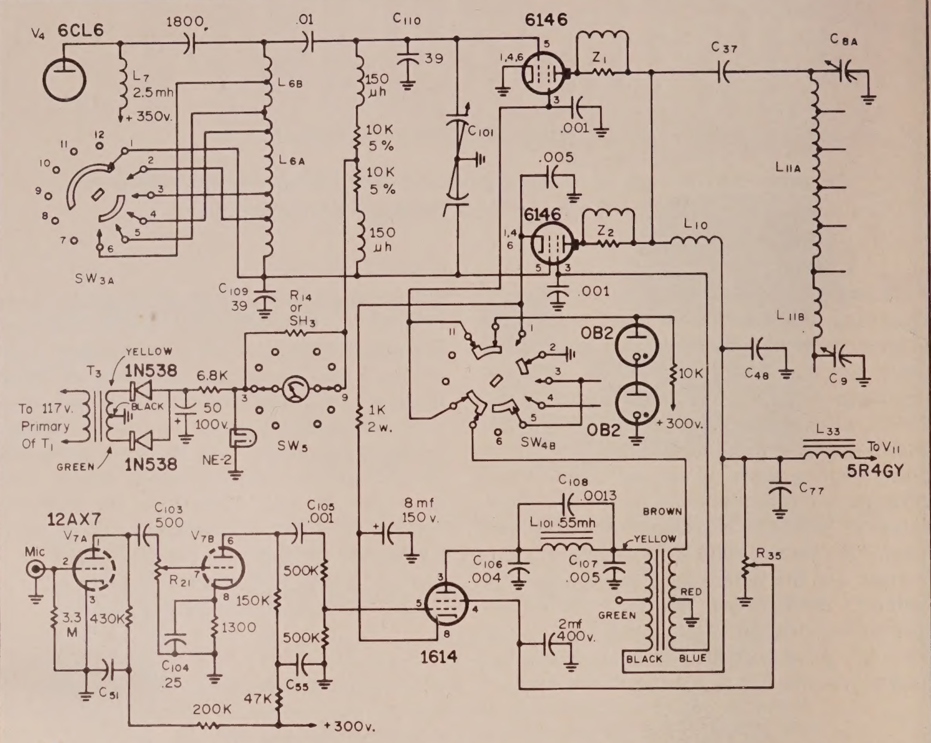

V₄ 6CL6
1800
.01
C₁₁₀
6146
1,4,6
5
3
Z₁
C₃₇
C₈A
39
L₇
2.5 mh
+350v.
L₆B
150 µh
10K 5%
10K 5%
150 µh
C₁₀₁
.001
.005
L₁₁A
L₆A
12
11
10
9
8
7
1
2
3
4
5
6
SW₃A
6146
1,4
6
5
3
Z₂
L₁₀
.001
C₁₀₉ 39
R₁₄ or SH₃
L₁₁B
OB2
OB2
10K
+300v.
C₄₈
C₉
SW₄B
SW₅
YELLOW
T₃
1N538
6.8K
BLACK
50 100v.
To 117v. Primary Of T₁
GREEN
1N538
NE-2
1K 2w.
L₃₃
To V₁₁ 5R4GY
C₇₇
C₁₀₈ .0013
L₁₀₁ .55mh
BROWN
YELLOW
8 mf 150 v.
C₁₀₃ 500
C₁₀₅ .001
12AX7
V₇A
V₇B
Mic
R₂₁
150K
500K
500K
C₁₀₆ .004
C₁₀₇ .005
R₃₅
RED
GREEN
2mf 400v.
3.3 M
430K
1300
C₁₀₄ .25
C₅₁
C₅₅
1614
BLACK
BLUE
200K
47K
+300v.

Fig. 2—Partial schematic of the modified Viking Ranger showing the changes made for d.s.b. operation. Those components with part numbers greater than 100 are new; other part numbers correspond to those in the Ranger manual.

C_{101}—Small two-gang 100 mmf per section variable. Jackson Bros. type 02 5250/2/100 pf.
C_{103}—500 mmf 300 v.
C_{104}—.25 mf 100 v.
C_{105}—.001 mf 300 v.
C_{106}—.004 mf 1500 v.
C_{107}—.005 mf 1500 v.
C_{108}—.0013 mf 500 v.
C_{109}, C_{110}—39 mmf ±5% 500 v.
L_{101}—.55 h. (1 Henry choke with increased air-gap).

only a small amount of audio power is required.

In the case of the Ranger the final is a single 6146. If we substitute two 6146's, lashed up as a balanced modulator, we will have d.s.b. Since only a small amount of audio is required we can throw out part of the original modulator, and thus save enough heater and B+ power to run the additional 6146. The original final plate circuit works fine as-is with two 6146's. Push-pull audio for the screen grids is certainly no problem; I used the original modulation transformer, although a smaller center-tapped transformer could also have been used.

A source of push-pull r.f. drive for the balanced modulator control grids is not quite so easy, however. The original exciter delivered 160 through 10 meter single-ended drive to the 6146 final. This had to be converted to push-pull drive without drastically modifying the original bandswitching arrangement of the Ranger exciter circuits. It looked like a real sticky problem and I first tried the classical approach of transformer coupling. Many different types of r.f. transformers were tried, including r.f. toroids, but none had sufficient bandwidth at this impedance level. Some worked fine on 3 or 4 adjacent bands but none would cover 160 through 10 or even 80 through 10.

Finally I tried making the 6146 grid tank (or buffer plate tank) into a balanced tuned circuit by simply substituting a split-stator tuning capacitor for the original single-gang 50 mmf variable. Surprisingly, this worked very well and my fears of circuit unbalance turned out to be completely unfounded, as grid drive is very closely balanced on all bands.

The two-gang, 100 mmf per-section tuning capacitor which replaces the original 50 mmf "buffer tuning" (C_7 in the Ranger manual) is an item not readily available from the mail-order houses. This capacitor must be physically small to fit in the available space under the 6146 mounting plate. A suitable capacitor is made by Jackson Bros., Ltd. of England. It is available in the U.S. from Barry Electronics, 512 Broadway, New York, N.Y. 10012 for $5.75 postpaid. Order part number 02 5250/2/100 pf.

Bias and Power Supplies

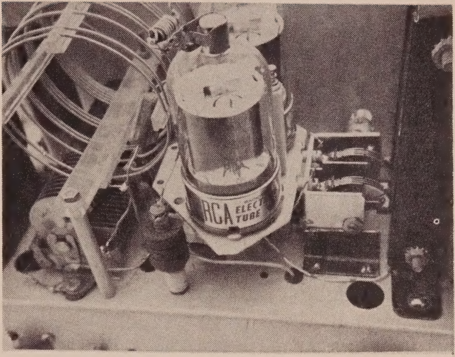
Originally the final amplifier was protected by a 6AQ5 clamp tube. Since the clamp tube circuitry was not compatible with a balanced-modulator final it was necessary to substitute protective grid bias for the 6146's. The Ranger that I converted was an early model which did not have the negative bias supply of the later Ranger I's and II's. If you have a later model Ranger you can probably use the built-in bias supply for protective bias on the final. About 50 or 60 volts are needed to bias the 6146's to cut-off.

For my bias supply I used transformer T_3, the original modulator driver transformer, as the power transformer; it works fine at 60 cycles. The NE-2 neon lamp provides regulation and carries the 6146 grid current when drive is applied.

No power supply changes were made in my transmitter but it would have been a good idea to replace both the 5R4 and 6AX5 rectifiers with 2000 p.i.v., 200 ma silicon diodes. This would increase power supply voltage, improve efficiency, and reduce the amount of heat generated inside the cabinet. Probably the easiest way to install silicon rectifiers would be to connect them to appropriate pins of an old octal tube base and simply plug them in the rectifier sockets.

C.W.

C.w. operation is not adversely affected by substituting a balanced modulator for the original final. On c.w. one of the 6146 cathodes is disconnected from ground by SW_{4B}, thereby making it inoperative. C.w. output from the other 6146 is essentially the same as in the original transmitter. It was necessary to regulate the screen grid voltage of the 6146 used on c.w. This is handled by the two 0B2's in series, although a 210 volt, 10 watt Zener diode could also have been used.



The original Ranger final is replaced with two 6146's mounted on a small plate which in turn is supported 1½" above the chassis. The two-gang Jackson Bros. tuning capacitor is at the right.

Audio

Speech clipping should be used if the full advantages of d.s.b. are to be exploited. Since clipping tends to emphasize the lower speech frequencies the audio response should be made to fall off below 500 cycles before clipping occurs.

The original 12AX7 speech amplifier tube is used for the audio but some component values have been changed to give a more desirable frequency response characteristic. The lower audio frequencies are attenuated by th small values used for C_{103}, C_{104}, and C_{105}, (fig. 2).

One of the original 1614 modulator tubes (7027 in the Ranger II), cathode biased, is used as a class-A modulator for the 6146 screen grids. This tube also acts as the speech clipper simply by being over-driven.

The turns ratio of the original modulation transformer is about right if it is hooked up backwards, using the entire secondary as the primary.

A good low-pass audio filter with very

sharp cut-off above 3000 cycles is needed on the output of the 1614 clipper-modulator to limit the bandwidth of the transmitted signal. This filter is made up of C_{106}, C_{107}, C_{108}, and L_{101} in fig. 2. Inductor L_{101} can be made from a small 1 Henry or 1/2 Henry choke by increasing the air-gap to reduce the inductance. This choke should have a fairly good Q; mine had a Q of 13 at 1000 cycles.

Overall audio frequency response as measured from the microphone input to the balanced modulator screen grids is shown in fig. 3. Be sure your high frequency cut off is at least as good as fig. 3 because it is this response that determines the bandwidth of the transmitted signal.

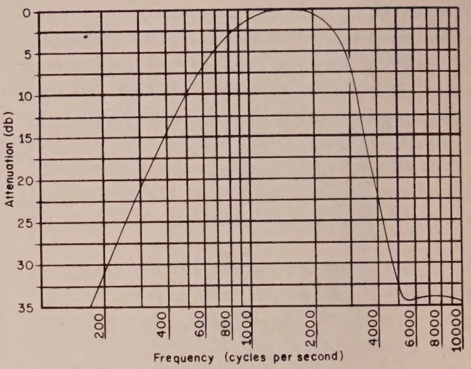


Fig. 3—Measured audio frequency response of the modifed Ranger.

R.F. Circuit Changes

The first step in conversion of your Ranger is to order the Jackson Bros. split-stator capacitor for C_{101} from Barry Electronics, or what ever other source you can find.

While waiting for delivery of this part you can remove the clamp tube circuitry and substitute protective bias for the 6146 final. You will also need to regulate the screen grid voltage of the 6146 for c.w. operation. When these changes have been made check out the transmitter to make sure it works as well as before on both a.m. and c.w. It's a good idea to check out the rig as far as possible after each circuit change; mistakes are then easiest to track down.

When you have the two-gang capacitor for C_{101} you can proceed with the major changes. Remove the 6146 socket, the BUFFER TUNING capacitor, and the aluminum shield that covers part of the bandswitch underneath the chassis. This shield does not seem to be necessary and was permanently omitted in my rig. Save the high-voltage capacitors, C_{47} and C_{48}, and the r.f. choke, L_{10}.

The new BUFFER TUNING capacitor, C_{101}, is mounted 1½″ back from the rear apron at a point where the shaft will be lined up with the BUFFER TUNING knob on the front panel. A 3/8″ clearance hole for the shaft must be drilled in the large shield plate located near the middle of the chassis. The original shaft extension is too short for use with the Jackson Bros. capacitor; it should be replaced with a quarter-inch shaft 8.8″ long.

Capacitor C_{101} is mounted on its side with the rotor plates opening out toward the power transformer. Probably the easiest way to mount the capacitor is to solder an L-shaped bracket to the rear of the frame which in turn can be bolted to the chassis. Connections are made to the stator terminals on both "sides" (top and bottom); the 6146 grids connect to the top terminals. One of the lower terminals will be accessible through the hole that formerly carried the 6146 socket. A 1/2″ clearance hole should be drilled in the chassis directly below the other stator terminal so that connections can be made to it.

The two 6146 sockets are mounted on a 2″ by 4″ aluminum plate as close together as possible, which turns out to be about 1.9″ center to center. The plate in turn is supported 1½″ above the chassis by metal spacers. All wiring is done on the sockets before the plate is mounted in place as the socket terminals are not easily accessible afterward.

The only changes made on the plate side of the final is to substitute two identical parasitic suppressors, Z_1 and Z_2, for the original one (L_9 in the Ranger manual). These are 8 turns of #22 wire wound around a 36 ohm, 1 watt resistor.

Switching

The original OPERATE or function switch (SW_4) can be used as-is if the rear wafer (SW_4B) is rewired as shown in fig. 2. This switch has been drawn as it would look from the front, in the OFF position, as it is in the Ranger manual. When working on the switch you will be looking at it from the rear and everything will be reversed from fig. 2; it will be necessary to count the terminals counter-clockwise instead of clock-wise. Notice that in the C.W. position one 6146 cathode as well as the 1614 cathode is removed from ground and the other 6146 screen grid is connected to +210 volts.

Rewiring of the OPERATE switch is a bit complicated and a thorough ohmeter check should be made on all associated circuits with the switch in each position before power is applied to the transmitter.

In my Ranger there was a rivet connection between the two sections of SW_{3A} which placed B+ on one 6146 control grid in one position of the bandswitch. This was corrected by bending the offending switch contacts away from the wiper blade.

Ranger II

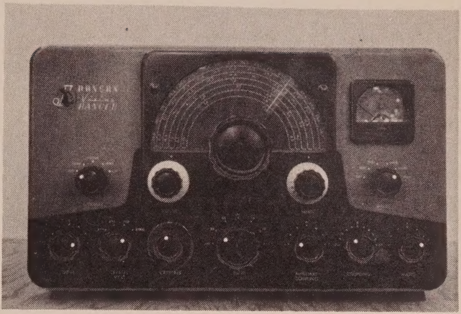
Offhand I would say the bandswitching arrangement of the Ranger II would rule out a simple conversion to give 160 through 6 meter d.s.b. You can discard the 5763 doubler and convert the Ranger II as I did this Ranger I to cover 160 through 10. Or you could easily have d.s.b. on six meters only, although you may find the v.f.o. stability to be a bit marginal for six meter sideband operation.

Testing

With all wiring completed it would be wise to make as many ohmeter checks as possible before applying power. In particular make sure the plate supplies are not shorted on any positions of the OPERATE switch, and that there is no B+ on L_6 in any position of the bandswitch. You can also check L_6 with a grid-dip oscillator for resonance at the appropriate frequency on each bandswitch position.

The next step would be to remove both rectifier tubes and apply power. Make sure all filaments are lit and that the 6146 control grids have proper negative bias.

If everything checks okay the 6AX5 rectifier can be plugged in and the exciter part of the transmitter checked out. Notice that an extra .01 mf d.c. blocking capacitor is included in the balanced modulator grid circuit so the two 6146 grids will be d.c. isolated from each other. This makes it possible to check for grid drive balance by measuring the d.c. voltage across each grid resistor. The two voltages should be equal within 10% on all bands. I found that the positions of the two shunt capacitors, C_{109} and C_{110}, were important in balancing the grid drive. The best position for C_{109} was close to the bandswitch, as it is drawn in fig. 2, and C_{110} wanted to be close to C_{101}. You may find that slightly unequal values for these two capacitors will be needed to properly balance the drive.


Viewed from the front, the d.s.b. modified Ranger appear completely unchanged.

If everything is working well in the exciter circuits you can plug in the 5R4 rectifier and check the complete transmitter on both phone and c.w. A 100 watt light bulb makes a good dummy load for these tests, it should light brightly on c.w. and somewhat less brightly when whistling into the microphone on d.s.b. If you have a 'scope you can check the modulation envelope, which should look like an s.s.b. two-tone test pattern when a sine-wave is applied to the audio input.

Tune-up and Operation

Tune-up procedure is essentially as it always was. Whether operating phone or c.w. it is handy to turn the mode switch to PHONE and tune the BUFFER for maximum grid current since plate current will be essentially zero in the PHONE position. The final is best tuned and loaded with the operate switch in the C.W. position and the key depressed. When working a number of different bands it's handy to keep a table showing the approximate settings for the BUFFER TUNING, FINAL TUNING and COUPLING controls on each band.

This Ranger has been used on both d.s.b. and c.w. for a number of years with good results. Recently I acquired a certain very popular 260 watt s.s.b. transceiver and set it up along side the Ranger with a coaxial relay for rapid switching between the two rigs. Comparison reports indicated very little difference as to either signal strength or quality. The lack of low-frequency audio response in the Ranger was sometimes mentioned but was always considered to be of "good communications quality." ■

F. M.

BY GLEN E. ZOOK,* K9STH/5

DECEMBER brings forth Christmas, the end of the first year of the FM COLUMN, and contest fever. The first item happens every year, and the kids enjoy it (kids from 0 to 100+, that is). The second item is the end of the first year, and, we hope, just the beginning. The third item, contest fever, strikes many amateurs all year long. However, the winter months make for more contests, especially those on v.h.f. These contests will be the subject of the monthly tirade.

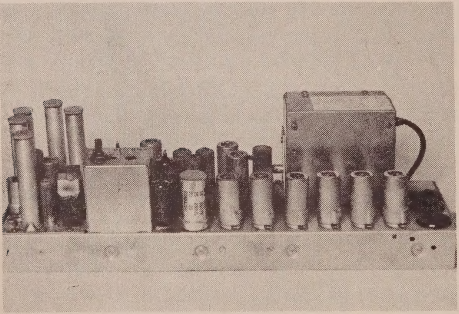
Contests are a lot of fun, and a challenge to many amateurs. On the v.h.f. and u.h.f. bands contests often make for a higher population than would otherwise be possible. Operating skill, equipment performance, propagation, and just plain luck play an important part in winning a v.h.f. contest. Also, it also helps sometimes to live in a large metropolitan area with a lot of v.h.f. amateurs. Now, here comes the bad part. Some amateurs do not read the fine print of contest rules. Most v.h.f. contests specifically rule-out any contacts made with one or both parties using a repeater. There are few methods which will lose friends faster than calling CQ Contest on a local repeater. Not only will you lose friends, but your contacts will not count anyway. The reasoning for prohibiting contest QSO's on a repeater are many, including the nusiance factor. F.m. in general, and repeaters in particular, represents a "party-line" type of network. The use of the local repeater to run up a large contest score is not only selfish in terms of frequency tie-up, but annoying to most people who monitor the repeater for long periods of time (this includes most active f.m. operators). I personally have heard stations using a.m. with m.c.w. on a repeater to try and get more points than just for a simple QSO. Since the limiters in the repeater receiver took out almost all the a.m. signal, you can imagine what the frequency sounded like for about five hours. And, all was for nothing, for the repeater QSO's were specifically prohibited by the contest rules.

Since contests using repeaters are prohibited, lets go one step further, and keep contest QSO's off the local f.m. frequencies. Not only not work contests on the repeater, but not direct on that or any other highly populated f.m. frequency in the local area. If one wants to work contests on f.m., fine, but go off onto the local f.m. DX frequency or some other not-so-populated frequency. Things would not be so bad if receivers were tunable, but crystal controlled receivers are one of the drawing cards of f.m. Don't cause bad feelings and long term repercussions for a few contest points. Work the contests, but not on 146.34, 146.94, 146.76, 146.82, 52.525, 449.1, or any other highly populated f.m. frequency. Enough of that for now.

220 MC Plan

I am going to stick my neck out a ways with a proposed 220 mc f.m. plan. Since Docket 18803 had not been acted upon at the time of this writing, it may throw cold water on the suggestions before they actually appear in print. However, there is a definite need to really get something going for a national 220 mc plan. The *ARRL Handbook* recommends 40 kc channel spacing starting at 220.020 mc. This is being followed somewhat on the West Coast. 220 mc f.m. activity is still very scarce in most areas, so no local standards have been adopted in many parts of the country. The EIA proposal for a Class E Citizens Radio Service on 220 mc has kindled a desire by some f.m. amateurs to get on the 220 mc band. W2JTP is doing his part with modifications of the Motorola "A" transmitter from 150 mc to 220 mc, and the Motorola "G" receiver from 150 mc to 220 mc in a series of articles which began in the October issue of *CQ*. The "Technical Talk" in this column this month will cover the Motorola Sensicon "A" and "G" transmitter. Thus, information on getting up on 220 mc is becoming available.

The EIA Class E plan has some merit in terms of frequency spacings. That plan called for 25 kc channel spacings and narrowband (± 5 kc devi-



The Sensicon "A" receiver looks the same before and after modification to 220 mc. This particular receiver hears 0.45 microvolts at 220.5 mc and rejects spurs 65 db or more. For the eagle-eyed, the cover had not been installed on the xtal oven when the photo was taken.

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*818 Brentwood Lane, Richardson, Texas 75080.

Group shot of the members present at the first meeting of the Japanese "Z" or F.M. Club. About 100 persons from JA1 and JA3 attended the meeting at Lake Hamana in JA2 land.

ation) f.m. By doing a little borrowing from the EIA a workable 220 mc band plan can be worked out for f.m. operation. On 2 meters 600 kc was originally picked for repeater input/output spacing because this represented the usual 3 db points for splitting transmitter from one frequency to another. Many amateurs have split around 1 mc between transmit frequencies with the obsolete commercial gear, but that is usually just as far as one can go, and power output is often down when split that far. Since most early 220 mc f.m. equipment is going to be modified from the commercial highband equipment, standards similar to those on 2 meters should work out fine. A split of 600 kc at 147 mc is about the same percentage as a split of 900 kc at 220 mc. So, 900 kc is a place to start for repeater input/output spacing. But, why not make things a little simpler and use 1 mc spacing. The percentage split is not that much greater, and it sure makes remembering frequencies a lot easier.

Now, let's look at channel spacing. The present commercial channels are spaced 30 kc on highband, with provision for 15 kc spacing which are being assigned in many areas at the present time). The commercial standards now call for 25 kc channel spacing on the 450 mc band, which have replaced the 50 kc channels from wideband days. 25 kc narrowband channels make for easy steps and give some room for the transmitter frequency tolerances. The 40 kc channel spacing with wideband would mean 20 kc spacing with narrowband, which is a little too close for many units which will be moved up from highband. These should be able to hold the 25 kc channels, and would do fine with 50 kc channels.

Finally, the f.m. operator must recognize the needs of other modes on 220 mc. Fortunately, most serious DX work known to the author is on the low end. This includes c.w., a.m., and s.s.b.

So, you ask, what is this grand and glorious proposition? Well, to use 50 kc channel spacing with wideband or, preferably narrowband, to start with, and going to the 25 kc channel spacing when activity requires closer channel spacing. Use 1 mc input/output spacing between repeater transmitter and receiver with input on the low side. As can be seen, this is a mixture of present two meter usage and the EIA 220 mc plan. The full picture is as follows:

220.0—220.5 mc	a.m., c.w., s.s.b., etc.
220.5—221.475	Primary f.m. Repeater inputs
221.5—222.475	Primary f.m. Depeater outputs/simplex
222.5—223.475	Secondary f.m. Repeater inputs
223.5—224.475	Secondary f.m. Repeater outputs/simplex
224.5—225.0	Control Links.

Channel spacing 50 kc with provision for 25 kc.

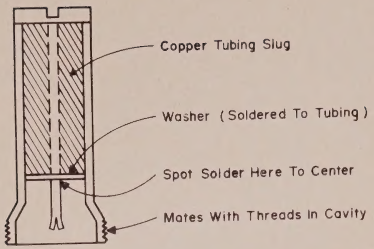
Wideband with trend towards narrowband.

Of course any local simplex, repeaters, or control links should take priority over any new repeater setup.

Technical Talk

The original plan for the December Technical Talk was for the addition of frequencies to obsolete commercial f.m. units. However, the assemblies have not arrived as of this writing. Thus, in keeping with the 220 mc activity the conversion of the Motorola "G" transmitter and Sensicon "A" receiver will be covered. Both units may be modified in less than one hour each. The Sensicon "A" receiver is popular for use in many 2 meter receivers and was used in the 80D and 140D mobile units as well as base stations. It is the one using five or six loaded cavities in the receiver front-end, The "G" transmitter has several variations, and was used in the 25 and 10 watt output "Twin-V" units of T43GGV fame and in the later "T-Power" units of U43GGT fame.

The receiver modification consists only of shortening the cavities. All other circuitry re-



Copper Tubing Slug
Washer (Soldered To Tubing)
Spot Solder Here To Center
Mates With Threads In Cavity

Fig. 1—All cavities in the Sensicon "A" are modified by the insertion of copper tuning slugs. See text for details. Modified cavities tune with top of assembly about 1" below the top of the cavity.

mains the same. The cavities in the receiver are tuned by an assembly which is about two inches long and travels up and down inside the basic receiver cavity. This assembly physically shortens the cavity when it is screwed towards the bottom of the cavity. The cavity itself has a capacitor built into the base and a center pin which runs up into the tuning assembly. These cavities are used in the r.f. amplifier stages and as the final multiplier tuning circuit for the 1st oscillator/multiplier chain.

All cavities are shortened by the addition of a slug approximately 1½ inches long into the movable assembly portion of the cavity. This slug is made from copper tubing. The tubing used in the modification of two receivers by the author has an outside diameter of ½ inch and an inside diameter of ⅜ inch. However, it is possible for the inside diameter of some receiver tuning assemblies to be a slight bit smaller, so take along one of the assemblies when buying the tubing. A #10 flat washer (cadmium plated) was soldered to one end of the piece of tubing. The entire slug was then inserted into the assembly, using care not to distort the center connection (see fig. 1) of the assembly. After the slug was inserted all the way to the end (sealed end) of the assembly it is spot soldered to the center connection taking care not to get any into the hollow portion of the center connection. This results in an effective length of about ½ inch from the open end of the assembly to the effective electrical end. The assembly is then returned to the cavity and screwed into place taking care to make sure the center connection of the assembly mates with the center pin of the cavity. All cavities are treated the same.

A few of the mobile units at the "Z" meeting at Lake Hamana in Japan.

Originally it was feared that the oscillator circuit would have to be modified to get sufficient injection. The original oscillator/multiplier chain in the Sensicon "A" uses crystals in the 30 mc range and multiplies by five. In the modified receiver the multiplication is times seven and crystals remain in the same range with no modification to the oscillator/multiplier circuitry except for the shortening of the final cavity.

The crystal should be calculated using the following formula:

$$Fx = \frac{Fc - 5.5 \text{ mc}}{7}$$

Where Fx = crystal frequency and Fc = carrier frequency.

Tuneup is exactly the same as when tuning on the highband commercial frequencies. The cavities tuned about 1 inch down from the top of the cavity to the top of the moving assembly. The injection was quite sufficient and both receivers exceeded original highband specifications for sensitivity and spurious responses. The original 20 db quieting sensitivity for a highband Sensicon "A" is 0.6 microvolts. The first receiver had a 20 db point of 0.45 microvolts and the second 0.5 microvolts. A bit of cheating was used on the first receiver, for it was completely retubed. The second only had a bad 6AK5 in the r.f. amplifier stage replaced. The maximum spurious response was the 1st oscillator image 11 mc down in frequency from the desired carrier frequency. It was about 65 db down in both receivers. Not bad at all. By the way, a variable speed reversable hand drill with a screwdriver blade will help when running the cavity assemblies in and out. One's hand gets very tired of turning a hand screwdriver.

Other materials besides the copper tubing slugs were originally tried including wadded-up aluminum foil. Each worked to a degree, but not near as well as the copper slug. Besides, if at a later date one wished to use the receiver on two meters, the slug can be removed fairly easily.

Now, for the transmitter. The "G" transmitter originally uses a 2E26 double-driver into a 6146 final amplifier. The 6146 becomes quite hard to tame at 220 mc (most books call for a maximum frequency of 175 mc). After several frustrating tries at neutralization the 6146 was jerked out and replaced with a 2E26. Although power is reduced, the 2E26 seems to be quite mild-mannered at 220 mc.

The actual modification was to short-out the driver plate coil per fig. 2 and do the same with the grid coil from the final. This can be done by unsoldering the spring clip which serves as a plate connection to the 2E26 driver, loosening the two (or three) nuts holding on the cover to the driver plate coil, and removing the nut holding the driver plate tuning capacitor. The shield over the driver plate and final grid coils can then be removed. The turns are shorted out with a solder bridge, and the cover returned to its proper place. The plate cap can then be resoldered. The coupling to the grid can be varied from under the chassis by sliding an assembly which is held in place by one of the nuts holding the shield in place.

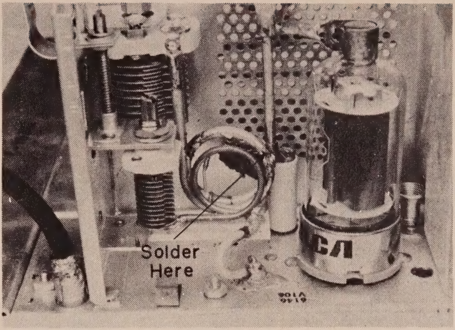
The final amplifier plate circuit is modified by shorting out the one turn-coil/line combination at the point indicated on the photograph. A short piece of wire and a bit of solder are all that is needed.

The modified transmitter now uses the driver stage as a tripler rather than a doubler and the final operates straight through. A quick check can be made with a grid-dip meter at the plate of the driver and final 2E26 tubes to insure that the stages are tuning correctly. Power output was about 2 to 3 watts with about 400 volts on the plate of the 2E26 final. Not enough to write home about, but enough for good local work or to drive a 5894 final. The final will be covered next month.

Now, as to how to order crystals. There are several variations in both the receiver and transmitter oscillators which require a different crystal type. Most amateurs know what type of crystal their unit requires. Then calculate the crystal frequency (not the operating frequency) by the formula given for the receiver or by dividing the desired carrier frequency by 36 in the case of the transmitter. Then order the crystal to be on that frequency and correlated to operate per Motorola type (whatever it is). The major manufacturers will furnish crystals that way.

DX

F.m. activity is not confined to the USA. I hear from G5AGK, Karl, about f.m. in the United Kingdom, once in a while. Karl sent along details of modifying the IC-2F to include a.m. reception sometime back (developed by G8CST) but I have not had space to include it. If anyone is interested, please let me know (include s.a.s.e.) and I will forward a copy.



Short out final tank coil at point marked to get on 220 mc. The final amplifier tube in the Motorola "G" transmitter must be replaced with a 2E26 for stability. No other modification is needed except for the driver plate and final grid coils.

Along the lines of f.m. activity in the United Kingdom I wonder if many US and Canadian f.m'ers have tried cross band between six meters and the British four meter (70.025 to 70.700 mc) band? Some of the six meter s.s.b. boys in the Dallas area have done it. I recently moved one of my six meter convertors up to that range. Even though we have channel 4 in Dallas, there is little interference from the video, so weak signals should come through. Also, a yagi cut for channel four can be used for receiving and are available at a reasonable cost. Just a thought to whet the appetites of the DX'ers among us.

Yuu, JH3DPB, sent photographs from the first meeting of the Club "Z," the Japanese f.m organization. About 100 persons were present at Lake Hamana on 3 and 4 July, 1971. Since repeaters are not legal at this time, most long-range QSO's must be made via automobile and eyeball. The hangout is 145.73 mc. With all the fine Japanese gear making it into the US, one can imagine what the boys are getting over there.

Texas VHF FM Society

The summer meeting/convention of the Texas VHF FM Society was held in Arlington, Texas, on 14 and 15 August, 1971. A statewide six meter plan was adopted. Also, resolutions aimed at accepting and helping the newcomer to f.m. were adopted. Although discussed to great lengths, a formal constitution for the organization was postponed until the winter meeting which will be held in Corpus Christi in February.

[*Continued on page 92*]

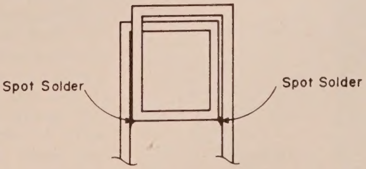
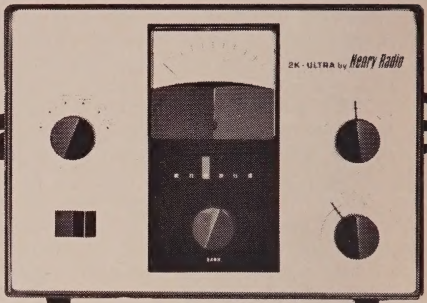


Fig. 2—The driver plate and final grid coils look much like this. Short out by soldering at points indicated. This will put the "G" transmitter stages on 220 mc. See the photo for final tank shorting details.

The Henry Family of Fine Amplifiers Grows and Grows a Gr



2K-ULTRA

There has never been an amateur linear amplifier like the new 2K ULTRA. Small and lightweight, yet rugged and reliable . . . all that the name implies. The ULTRA is destined to establish the standard for comparison for the 70's as the earlier Henry 2K series did in the 60's. It offers all of the fine quality, engineering and construction of its big brother, the 2K-4, condensed into a miniature powerhouse of radio frequency energy.

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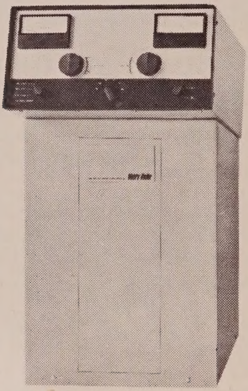
*Amateur Bands



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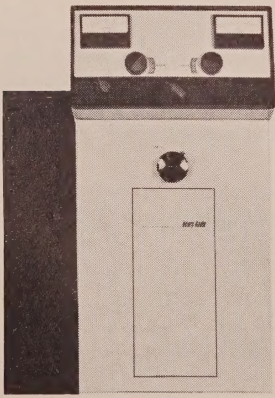

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A Different Approach to Front-End Design

Double Conversion With A Single Local Oscillator

BY HENRY J. PERRAS,* K1ZDI

It is generally accepted that the single conversion approach to receiver design has the basic drawback of a lack of image rejection, and therefore, we find the double and triple conversion approach in the more expensive units. More advanced designs have been rendered along the single conversion line by the use of multipole filters in the r.f. stage. This is effective, but of limited bandwith per filter, and expensive if purchased commercially.

Fundamentals of Front-Ends

Designing the r.f. amplifier for best noise figure, which becomes practical for frequencies above 30 mc, is best approached in the following manner.

1. The tuned circuit between the antenna and the r.f. amplifier should be of low *Q*. A *Q* of 6 is a good compromise. Values above this can start to seriously degrade the noise figure of the amplifier unless the unloaded *Q* of the circuit is very high. A low unloaded *Q* at this point increases losses of signal directly as oppsed to the collector of a transistor amplifier, which divide the losses by the gain of the amplifier. It must be pointed out that too much gain in an r.f. amplifier can be a detriment to performance by virtue of cross-modulation and intermodulation products that may occur. It is therefore best to accomplish most of the spurious response rejection in the collector circuit of the transistor r.f. amplifier. A *Q* of 20 or so is practical at this point provided that the unloaded *Q* of the coil is sufficient to avoid signal loss due to inefficiency.

2. Another job for the r.f. amplifier is to reduce local oscillator radiation. This is of no concern to the receiver, but can cause considerable interference to another some distance away. The problem is enhanced if a large frequency step-down with one mixer is to be used, for example, converting two meters to the 7-11 mc band. Insufficient image rejection now can become a problem also. A cascoded arrangement of the r.f. amplifier will give an improvement in the L.O. radiation problem into the antenna, or other problems involving instability due to feedback because of its reduction in "Miller Effect." This still does not solve the image problem. With a little trickery we can work our way around this problem, as will be explained next.

Double Conversion With One Local Oscillator

A different method that has not been tried before, to my knowledge, is to perform a double conversion by using two mixers being fed by a single local oscillator. A standard method has been to use a crystal for the first L.O. and a tunable second L.O. as has been popular with Collins and others.

How can double conversion be performed with one L.O.? Figure 1 shows the relationship of four selected frequencies in the two meter band, the L.O., and both mixers. The selection was made to show the number relationships in converting to the 7-11 mc band. By using single conversion the L.O. would be

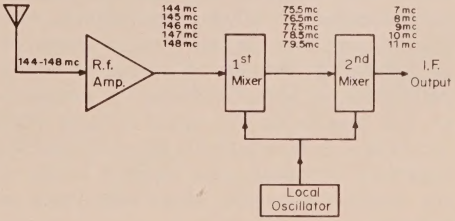

Fig. 1—Frequency relationships of mixers and local oscillator when using the single oscillator technique for 144 mc conversion to a 7 to 11 mc i.f. In this example the local oscillator is on the low side of the first i.f., although the high side could also be used as described in the text.

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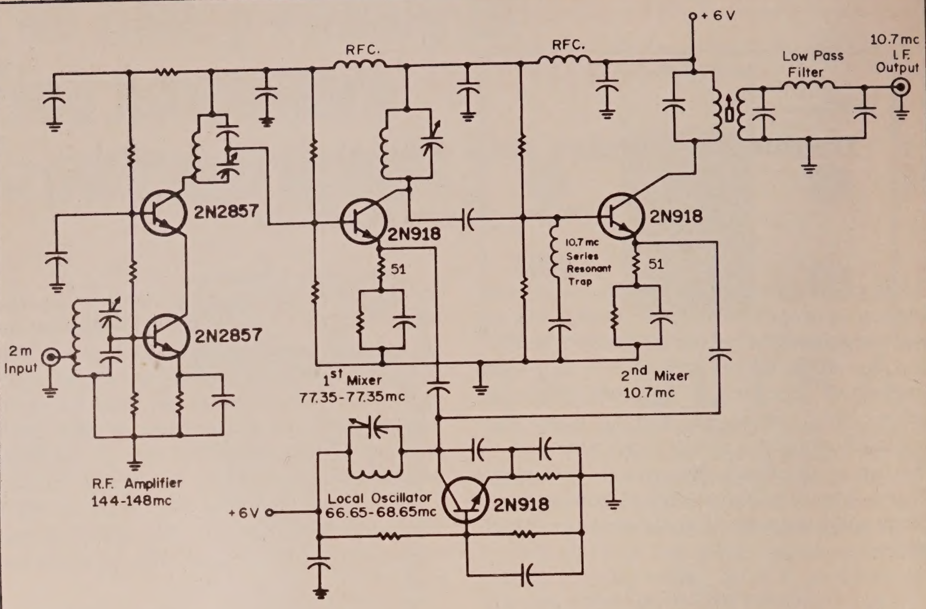

Fig. 2—A tunable 2-meter front end, using the technique described, to produce an i.f. of 10.7 mc with a single local oscillator. Note that the tuning range of the oscillator need only be 2 mc for full 4 mc coverage permitting more linear calibration of the tuning dial with greater ease. However, this "multiplying" feature also makes the design twice as susceptible to unwanted drift as a more conventional design, as any drift will also be doubled in its effect.

at either 137 mc or 151 mc for converting 144 mc to 7 mc. The choice of the L.O. being on the high or low side is restricted to which image band would give the most problem. If the selection were 137 mc, then the image frequency would be 151 mc, and vice-versa for a selection of 151 mc as the L.O. frequency. Obtaining adequate image rejection would be a problem in either case, along with minimizing L.O. radiation from the antenna. This would be very difficult, because an extremely high Q would be required with one r.f. amplifier, or more tuned stages by incorporating another r.f. stage, or multipole filters, or both. Obtaining the necessary Q and preserving the signal-to-noise ratio would be a delicate task. By using the method suggested previously and outlined in fig. 1, the double conversion would take place as follows:

$$\text{L.O. freq. (low side)} = \frac{144 - 7}{2} = 68.5 \text{ mc}$$

$$\text{1st i.f. freq.} = \frac{144 + 7}{2} = 75.5 \text{ mc}$$

The second i.f. would be tuned to the receiver input frequency, and in this case 7 mc. Using the receiver as a tunable i.f. the numbers for 148 mc would be as follows:

L.O. freq. (low side) = 68.5 mc as before

$$\text{1st i.f. freq.} = \frac{148 + 11}{2} = 79.5 \text{ mc}$$

The 79.5 mc beats again with the fixed 68.5 mc L.O. and produces the 11 mc in the second mixer. To perform the conversion with the L.O. on the high side, the formulas for the L.O. and 1st i.f. would be reversed. This could also work for any number of conversions by the formulas below.

$$\text{L.O. (low side)} = \frac{f_o - \textit{last i.f. freq.}}{N}$$

$$\text{L.O. (high side)} = \frac{f_o + \textit{last i.f. freq.}}{N}$$

where:

f_o = received freq.
N = number of conversions

The circuit in fig. 2 was constructed with very good results. In this particular conversion, sufficient rejection is provided between the first and second mixer by the use of a series resonant trap and a high *Q* collector tank. This was deemed necessary because in this particular conversion the 1st mixer falls in the TV channel 5 and 6 area. Along with trapping and adequate *Q*, the general rules pertaining to good bypassing, short leads, and proper shielding are necessary in order to preserve performance. Rejection to spurious signals greater than 50 db will be realized if these rules are followed along with this approach.

Emitter injection was used in this design for both mixers with excellent results by developing the injection across an unbypassed 51 ohm resistor. The slight degeneration experienced in conversion gain is compensated for by eliminating feedback in the second mixer through the use of the series resonant trap on the mixer base. The use of the unbypassed 51 ohm resistor eliminates clumsy tank circuits or tapped inductors. The circuit of fig. 2 was designed as a tunable front-end into a fixed 2nd i.f. and is not being presented as a construction reference. If the circuit were to be used with a crystal oscillator in a converter, an advantage would be realized in the fact the 1st mixer is accomplishing a form of multiplication that would ordinarily be the function of a doubler following the crystal oscillator.

Definite advantages can be realized by using the lower frequency crystals if for no other reason than the fact that stray capacitances and inductances will be minimized, and therefore the design and construction latitudes increased more comfortably.

If the technique of fig. 2 were used, a form of doubling exists in that the tuning range of the L.O. is cut in half, which reduces the size of the variable capacitor involved for external tuning.

This article was written to present an alternative to front-end design and not with detailed construction techniques in mind, although two units for the v.h.f. bands have been built with this method using bipolar transistors and a 6 v.d.c. supply with extremely good results. Total gain from antenna to i.f. output of around 30 db can be expected. ■

Zero Beat...Visually

BY W. R. SCHOPPE,* WB4DWA

An ordinary service scope will help provide a visual aid to the customary method of listening for zero beat. When used as outlined below, this simple procedure will improve your zero beating ability when spotting a transmitter to a properly tuned received s.s.b. signal or when adjusting a crystal calibrator to WWV.

While the conventional way of zeroing by listening with phones or a speaker is relatively accurate, phones are practically useless below a few hundred cycles, whereas a scope, when used as described, will give accuracy down to zero. It will *not*, however, correct for receiver tuning errors.

Scope Functions

At this QTH, the available equipment is a Heath OM-3, (of ancient vintage, to be sure), but almost any service or general purpose scope should work.

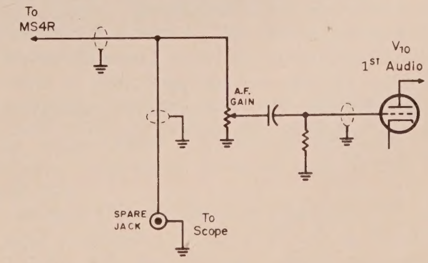

Fig. 1—High impedance audio is picked up from the "hot" side of the receiver audio gain control, and routed to a jack on the rear apron of the receiver through shielded wire. The circuit shown is of the Heath SB-300. Connection to the scope is through shielded wire, also.

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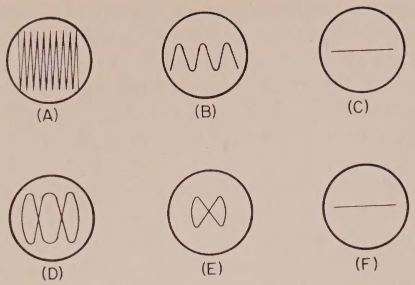

Fig. 2—(A) Scope pattern with transmitter about 1 kc from zero. (B) Approaching zero beat. (C) Zero beat. (D) With scope set up for Lissajous pattern instead of sine wave, pattern such as this will appear as zero beat is approached. (E) Close to zero. (F) Zero beat.

The OM-3 has a SYNC SELECTOR switch with three positions . . . INTERNAL SYNC, 60 CYCLES, EXTERNAL SYNC. Most scopes are similarly equipped but may operate in a different sequence.

When set to INTERNAL SYNC, the action of the scope is as follows: the incoming signal is applied to the VERTICAL INPUT terminals for amplification by the vertical amplifier. A sample of the amplified signal is taken from the cathode of the vertical output tube and applied to the sync amplifier via the SYNCH SELECTOR switch to be processed for use as a sync control pulse to provide a stationary pattern on the scope.

In the 60 CYCLES position, the synchronizing action results from low voltage a.c. from the filament winding of the scopes' power transformer being fed to the sync amplifier, amplified, then applied to the sweep circuit for control action. The EXTERNAL SYNC position is not used for zero beating.

The other switch of interest is the HORIZONTAL FREQUENCY selector. There are seven positions on this switch providing a wide range of sweep frequencies. For spotting we will use PHASE or 10/100 CYCLES.

Simple Receiver Modification

In this instance, a Heath SB-300 receiver, modified as shown in fig. 1, provides a high impedance audio signal from the 6AS11 product detector. The signal is routed to a spare jack on the rear apron of the chassis through shielded audio cable. Note that the volume control does not vary the level of the signal going to the scope, but retains its original function of varying the level in the phones or speaker. The audio fed to the scope is regulated by the vertical gain control without affecting the signal heard in the phones or the speaker.

How To Use

Connect scope by running a shielded cable from the spare jack on the receiver to the VERTICAL INPUT terminals on the scope. Set SYNC SELECTOR switch to INTERNAL and HORIZ. FREQ. to 10/100 CYCLES. Adjust all scope controls for normal operation. Tune in an s.s.b. signal as accurately as possible on the receiver, listening for what sounds like a normal voice on the phones or speaker.

A voice pattern should appear on the scope. Reduce the vertical gain to near minimum, (where the movement of the voice pattern is just discernible). Turn on the transmitter and zero beat as usual using the SPOT or ZERO position. Observe the scope and note that as the frequency of the spotting signal approaches the frequency of the incoming signal, a high frequency sine wave will appear as in fig. 2(A).

As you tune further and get closer to zero beat, the sine wave frequency and amplitude will start to diminish as in fig. 2(B). At exact zero beat, the sine wave will collapse to a thin horizontal line as shown at fig. 2(C). If you continue tuning in the same direction, the sine wave will again appear, indicating you have departed from zero beat. By rocking the transmitter tuning dial back and forth, you can achieve zero beat very easily and accurately by observing the *disappearance* of the sine wave. You may notice that when you think you have an aural zero beat on the phones, the scope might still display a sine wave of low frequency. It is here that visual zero beating has the advantage of accuracy, indicating that you could not detect true zero beat by listening.

An alternate and equally effective method will produce lissajous patterns. In this set-up, the SYNC SEL. is set to 60 CYCLES and the HORIZ. FREQ. is set to PHASE. With these settings and tuning as before, as you approach zero beat, lissajous patterns will appear on the scope instead of sine waves as shown at fig 2 (D), (E), and (F). However, the same end result is obtained. At zero beat, the scope pattern will collapse to the thin horizontal line. The lissajous pattern will reappear as you pass zero beat.

[*Continued on page 92*]

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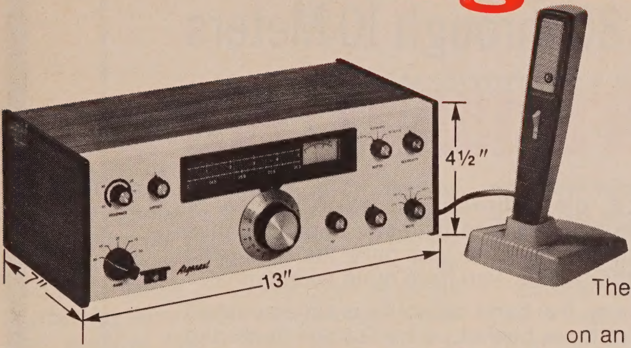

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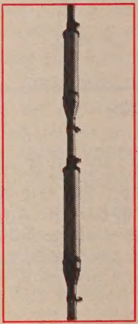

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OVERCOMING FILTER INSERTION LOSS

BY IRVING M. GOTTLIEB,* W6HDM

WHAT's in a name? Well, at the mention of *image-parameter filters,* do you envisage far-out networks best left to the ivory-tower fringe? Such notions are sad departures from fact since "image parameter filter" is simply engineering terminology for most commonly-used selective filters. True, some study is needed and some hardware implementation is desirable to get the "feel" of these classical selective-circuits. But the math involved is on par with the simple equations used in familiar circuit computations. The principle of the image-parameter filter pops up in such applications as TVI filters, i.f. selectivity filters, single sideband filters, hi fi cross-over networks, antenna matching networks, filters for separating code signals of different pitch, etc. Although computer-aided design and active filters represent clear trends, image-parameter design remains admirably suited for many purposes, including amateur radio.

Even the most primitive filter has a mystique deeply respected by veteran designers. Consider the response for the elemental low-pass type shown in fig. 1. Common sense would likely not suggest the nature of this response. Why should the attenuation from zero-frequency (d.c.) to the vicinity of the cutoff frequency, f_c, be so nice and flat? Thereafter, why does the response change tack, the attenuation of the signal becoming ever greater with increasing frequency? If this does not appear to be amazing, it is respectfully submitted that the likelihood of stumbling across such a response by empirically playing with various combinations of components would be quite low. Similarly, the bandpass response of fig. 2 is duck's soup for the image-parameter filter. It *cannot* be achieved by indiscriminately combining resonant circuits, no matter what their Q. Only approximations to the flat passband reward such techniques as stagger-tuning, double-tuned transformers, or other gimmicks for manipulating response.

Enough now with prelude—space and time do not suffice to instruct in the design of the image-parameter filter. The message of this article is frankly directed to those already versed in image-parameter design. However, those who are not, but who are willing to self-study the subject in a text or an engineering handbook will have no difficulty in appreciating the essence of the innovation about to be discussed. Interest will be confined to the bandpass type and we will deal with a simple and often-encountered circuit, comprising two full constant k sections.

It is not uncommon to read in an advertisement describing a commercial bandpass filter that the insertion loss is, say 1/2 db. That indeed could be. However, it is not unlikely

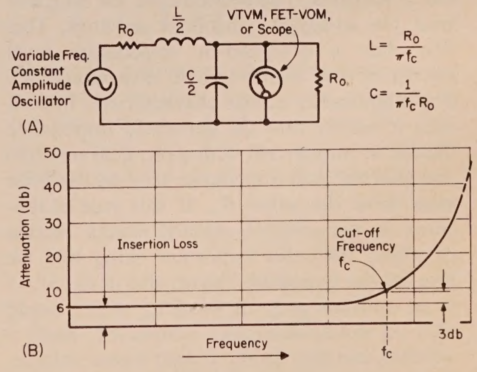

Fig. 1—An example of an image parameter filter. (A) Configuration and design formulas for low-pass filter. (B) General nature of frequency response for image parameter low-pass filters. Note flat passband.

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*931 Olive St., Menlo Park, Cal. 94025.

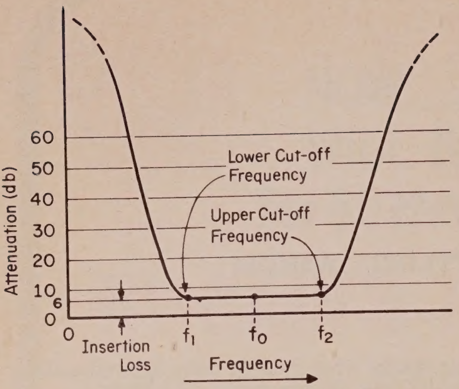

Fig. 2—Generalized frequency response for image parameter filters of the band-pass type. Note the flat response in the major portion of the passband, and the 6 db. insertion loss.

that we have before us a case of "sales-department engineering." It so happens that an image-parameter filter, unless modified in some way, inherently loses one-half of the signal voltage which would otherwise be available across the open terminals of the signal generator. In other words, the filter exhibits a 6 db loss. Practical filters actually exceed this idealized loss because of dissipation in the filter elements, usually the inductors. So, it is quite probable that the filter with the cited one-half db loss really causes a voltage loss of 6½ db.

Figure 3(A) shows the circuit of an image-parameter bandpass filter making use of two full pi sections. The sections are the simplest kind, the so-called constant-k network. This filter has a designed-in impedance level known as the *characteristic impedance* R_o. The significance of the characteristic impedance is simply that the generator impedance (actual or improvised with a physical resistor) and also the load impedance seen by the filter must have the value R_o. If this rule-of-the-game is not obeyed, nature exacts certain penalties, the most important being that we lose the flat passband. Shown also in fig. 3(A) is an optional step-up winding, which could also be autotransformer connected. Such a winding can step up the output signal voltage, thereby overcoming the insertion loss. But this is not always as cut-and-dried as one might suppose. Often, there is no available winding space on the toroid or cup-core inductor. And if there is, one has to achieve very tight coupling because the effect of leakage inductance is invariably to ruin the response. At the higher audio, and certainly with radio frequencies, the distributed capacity of the additional winding can produce all kinds of anamolies in the response. (These have been known to manifest themselves *after the* designer happily commits his fine filter to production, naively assuming that his postscript instruction to add a step-up winding to the output inductor can only lead to more joy.)

All this being so, it obviously would be nice to find *another* output voltage step-up method more amenable to implementation. Indeed, let's see what we can do. It is old-hat to the veteran filter man that the filter of fig. 3(B) is very nearly identical in performance to the one we have considered in fig. 3(A). The difference is that fig. 3(B) uses two full T sections whereas fig. 3(A) is comprised of two full pi sections. At first inspection we have retrogressed, for now we *cannot* use an output secondary winding.

Now consider the network shown in fig. 3(C). It differs from the "conventional" circuit of fig. 3(B) in the derivation of the output. The output is now obtained from the junction of the output series-arm *L-C* elements. This unorthodox output is at a higher impedance-level than the characteristic impedance of the filter itself. In order to ensure that unintentional tuning and attenuating effects are not introduced, let us specify that this new output must now be fed to a high impedance circuit such as an oscilloscope, a vacuum-tube or FET amplifier, a boot-strapped emitter follower using bipolar transistors, a high impedance voltmeter, or crystal headphones. Observation of the behavior of such a set-up leads to the useful discovery that the filter remains perfectly happy; it operates in substantially the same way it does when we monitor the output across load resistance R_o, but with one exception. This departure from conventional behavior is that the new output voltage is stepped up from the "natural" −6db level. The step-up ratio is found to be approximately $\frac{f_o}{f_2-f_1}$. Here, f_2 and f_1 represent the upper and lower cutoff frequencies respectively. The cutoff frequencies are those frequencies at which the response of the filter is 3 db down in amplitude from that prevailing for the center frequency, f_o. For the purpose at hand, f_o can be said to be half way between f_2 and f_1.

The new output impedance level is stepped up by the square of the above-discussed voltage step-up. Thus, if we achieve a voltage step-up of five, the impedance level of a filter designed for $R_o = 1000$ ohms will be increased twenty-five times, becoming 25,000 ohms. Now, it must be emphasized that we do not wish to impedance-match a load to our *new* output; that requisite remains the function of "conventional" output resistor, R_o, which we have left in the circuit. Rather, the new "load" should be perhaps twenty to fifty times 25 K ohms. Moreover, capacitance or inductance associated with the new load tends to degrade the voltage step-up and can detune the filter. That is why we go whole-hog and specify high-impedance loads.

What about the new response? Fortunately, it turns out that the response of the filter as deployed in figs. 3(C) and 3(B) are very similar over the percentage bandwidths that are usually encountered. Suffice to say that this technique will be found useful for a large number of practical filter applications. In many cases a truer-to-ideal response will result than from the use of the step-up winding of fig. 3(A).

Experimental evidence from single-section filters and from networks making use of three and four sections show that the more sections used, the closer the stepped-up response follows the response obtained at the conventional output. With a little experimental enthusiasm, it is conceivable that this technique can be extended for other purposes. For example, if used at the *input* of the filter, we might take care of the situation where a relatively high-impedance signal source must interface with a lower-impedance filter. (Sometimes, the characteristic impedance of the filter cannot be too high because of the resultant impractibility of inductor or capacitor sizes.) In any event we can summarize that we have at hand a simple, non-electronic method for overcoming filter insertion-loss; the engineering department can rejoice and the sales department need not fend off accusations of deception. (It can now advertise under the caption, "Gratis Gain for the Ham.")

Appendix

The following formulas may be used to compute the inductance and capacitance values for the filters shown in fig. 3. The units computed by these formulas are in ohms, henries and farads. Conversion to units common to communications is best carried out after solution has been made. Also, in using these formulas, always express frequencies in c.p.s.

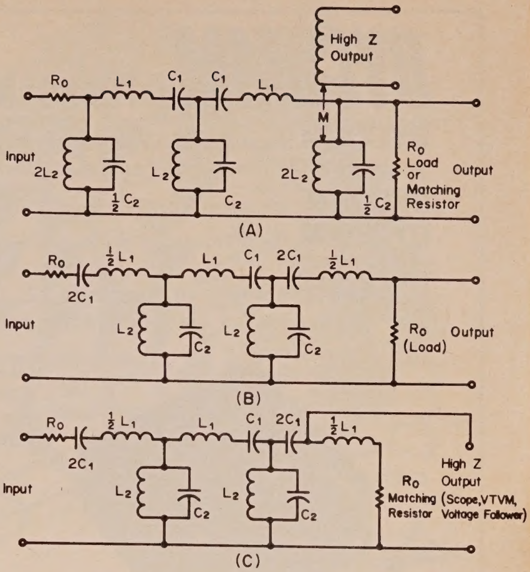

Fig. 3—(A) Typical bandpass filter with optional secondary winding on output inductor for stepping up output voltage to overcome insertion loss. (B) Equivalent circuit to that of (A) but using T sections rather than pi. (C) Method for obtaining "free" increase in filter output voltage. Unique deployment of filter at (B) yields an output voltage step-up without the use of a secondary winding.

$$L_1 = \frac{R_o}{\pi\,(f_2 - f_1)}$$

where R_o represents the characteristic impedance of the filter. Its choice is governed by the generator and load resistances the filter will be used with. f_2 is the upper cut-off frequency; f_1 is the lower cut-off frequency.

$$C_1 = \frac{f_2 - f_1}{4\pi\, f_2 \cdot f_1 \cdot R_o}$$

$$L_1 = \frac{R_o\,(f_2 - f_1)}{4\pi\, f_2 \cdot f_1}$$

$$C_2 = \frac{1}{\pi\,(f_2 - f_1)\,R_o}$$

Formulas from *Standard Handbook for Electrical Engineers,* A. E. Knowlton, 7th edition, page 95. ■

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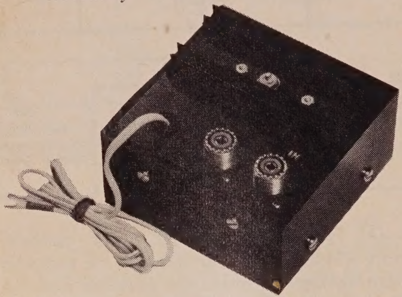
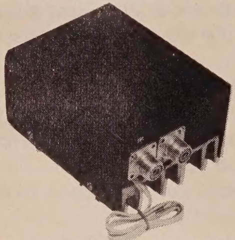


500C	"FM Booster", 4–12W in, 15–30W out 10W input/output 25W	**$ 59.95**



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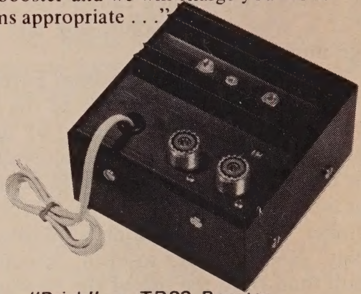
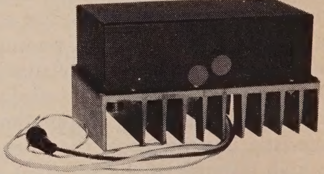
JIM – W4MRI
(305) 844-1323/
844-1324.



500E	"Brick" or TR22 Booster, one of the most popular, your 1–2W HT can push out 20–25W	**$ 69.95**
500ES	"Super Brick/TR22 Booster", now you can have from 35–45W for .8–2 watts input. Typically 38W output/1W input	**$ 99.95**



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35–0	Provides 80–110W output for 25–40W input, typically 100W output for 35W input	**$165.00**

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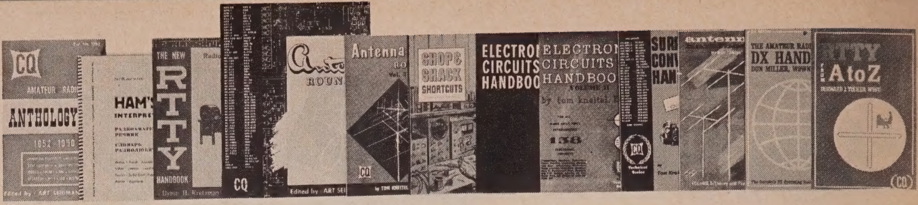

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CQ 160 Meter Contest Report

Just in time for the 13th Annual test come the results of the 12th!

BY CHARLES M. O'BRIEN,* W2EQS

CAN it be possible that 12 years have elapsed since the 1st annual *CQ* 160 Contest was inaugurated? Many of the boys who were with us then are still with us. Others may have dropped out for a period, for one reason or another, but find their way back. It's a good Contest; it's catching; it's challenging; it takes guts and good operating know-how to make the most of it. I just used the word "challenging." Indeed it is. Working many of the hard-to-get states on other bands is simple by comparison. To work DX on the higher frequency bands is commonplace but is such a thrilling reward that no one ever forgets on this lowest frequency ham band. Some of the countries that showed up for this Contest are even hard nuts to crack on *any* of our other bands. How about ZD8, ZD9, KR8, JD1, VS6, HK0 to mention but a few???

For the 1971 contest poor conditions existed on a world-wide basis. It was the same story no matter where the logs came from... Friday night/Saturday morning, conditions fair to good; Saturday night/Sunday morning, conditions horrible. Quite a few of the boys gave up in utter disgust and despair that 2d night. You could hear signals in there but couldn't identify any but the strongest.

W9DL is to be complimented and congratulated in working all States but Alaska. Too bad he didn't make that one as KL7CL was on but sent in no log. Incidentally, this is the first time in contest history that *all* 50 states were on. All VE districts were also on for the first time with the only missing Province being Prince Edward Island from which there has never been any Contest entrant.

Rules, regulations and logs were sent to stations in 46 different countries. Too bad that all didn't get on but 38 (the most we've ever had) out of 46 is a fairly respectable average. Many didn't submit their logs apparently due to the small number of QSOs. Fellows, no matter how small a log listing you had, shoot it in as they all go in the same hopper and make for interesting reading. Several logs made mention of an SV. OH0 and TF but their calls weren't mentioned in their comments and no logs were received from those three countries.

Regardless of conditions, the highest multiplier ever made in this Contest came to 67 and is the effort of K1PBW. And, the greatest number of countries ever worked came to 24 shared by KV4FZ and K1PBW.

In this contest 1358 stations from 38 countries participated. Of these, 745 were in the U.S., 22 (very disappointing) in Canada and 591 DX.

We would like to ask the W/VE c.w. stations to say out of the "DX Window" (normally 1825/30 but in contest 1825/35 kc) and will the DX please refuse to QSO any W's or VE's working there. That will make the W/

The smile on that face is from none other than Tim, K3RUQ. You, too, would be smiling after knocking off 216 QSOs to 10 countries with a multiplier of 52. Pete, WA2USX helped.

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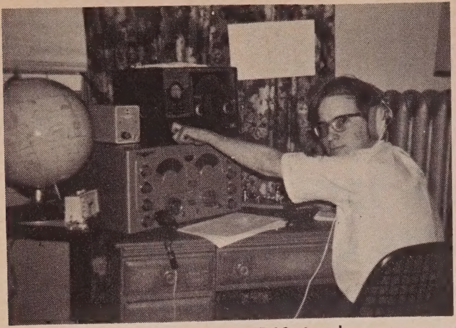
*190 Knickerbocker Road, Apt. 9, Englewood, N.J.. 07631.



Here is young blood on 160 in the person of WB9BUV, Charlie, from Indiana. He finished 2nd in Indiana.

VE boys catch on and QSY. In this past contest there were too many W/DX QSOs in the DX Window. The DX is just as guilty if they do work W/VE within this frequency range.

An important point for the DX boys to note. A QSO to each state and province gives you an extra multiplier plus the 10 points you obtain for such a contact. But, on top of this you cannot count the United States and Canada/Newfoundland as separate country multipliers, too. Also, KP4 and KV4 are not states. For DX, QSOs to them they are 5 pointers; for W/VE QSOs to them they are 10 pointers. KH6 and KL7 count as countries for multipliers but not *both* a State *and* country multiplier. They are, however, counted as 10 point contacts by everyone except KH6 to KH6 or KL7 to KL7 which are 2 pointers.

Remember that this Contest is a yearly event that is scheduled to run over the last full week-end of January from 0001 GMT Saturday to 1600 GMT Sunday (For the west coast boys and those in Oceania and Asia, please note we have extended the contest to 1600 GMT as many trans-Pacific crossings take place during that last hour. This has been done in response to the requests of so many W6/W7.

A most attractive certificate shall be sent the winners in each state, province and DX country and, in cases where scores are close, a certificate shall also be sent to 2d and 3d place contestants.

Comments

K1PBW: Re condx. Guess most everyone will be giving the same story but, like most everyone else, I was far ahead of what I had done in years past by Saturday morning and was doing great until Saturday night rolled around. *W1WY:* Boy, we sure hit a stinker this year. Think it was just about the worst one we have had. It's a good thing a few were on from the Caribbean area or DX would have been a complete washout. *WODRE/1:* Gosh, the Europeans sure are loud in this part of the country on Top Band. I rarely heard them when I was in Iowa. Wait till next year. *W1PL:* Biggest thrill was getting through 2d night's QRN to EI9J. *W1BB:* Always big thrill just to be on with the gang. Some mighty fine operating. Enjoyed every minute of it. Sorry I couldn't put in more time. (Stew had the misfortune of losing his inverted Vee with apex atop a huge water tank—ed.)

W2FJ: Funny thing happened to me on my way to the forum. Wasn't that Saturday night QRN awful? *W2TA:* Wait until next year. (John, how long do we have to wait?—*ed.*) *W2OZW:* Well, I'm sorry I made such a poor showing this year. Coming down with the flu and the QRN on the 2d day are logical excuses. *W2HUG:* I was only able to operate for one hour but got a new state (La.) and a new country (HK0) so it was well worth it! *W2IU:* Heard lots of DX stations but so many of them answered W/VE in the DX window. If we are to have a DX window it's at least up to the DX to keep the Ws in hand. They can, too, if they flatly refuse to work the offenders. In my book the DX are also offenders if they violate what many of the gang have tried so hard to establish. (Very well put, Sam. *ed.*) *W2AGQ:* Conds 1st nite

W3NNK: This is less than half of last year's score. I was going to make a "max effort" on Saturday nite but there was just too much QRN. No sense knocking yourself out if the sigs are below the local noise level. I did pick up 2 more states for 160 WAS. Need only 4 more. There's always next year. *W3IN:* 1st nite condx fantastic! 2d nite a disaster! Static like in July. Averaged 1.2 QSOs per hour for the last 12 during which keyer quit but straight key proved plenty fast for those condx. *W3FA:* Antenna vertical wire against ground. I obeyed all the laws. I had a ball. *W3FSP:* Here's the log on my feeble effort with antenna consisting of random wire through the walls and attic of the house. *W3AJS:* 1st nite condx very good but

WA4DRU: I had a lot of fun in my 1st contest. Will be back next year with a better antenna system and hope for less QRN which was very bad. *W4TMR:* Got off to a good start 1st nite and figured to break my North Carolina record score of last year for sure but 2d nite was almost total loss due to the worst QRN I've heard in months. *K4DBV:* You've predicted the sunspots OK. How about predicting the weather? QRN was terrible! (Do you know, Dick, that the weatherman ie the only one who can make mistakes over and over again and not be fired??—*ed.*) *W4HYY:* I didn't enter last year because of no antenna. This year I finally succeeded getting "THE" antenna I've craved for the past several years. It's a 70′ grounded tower with a tri-band beam on top.

K5TFG: Had a ball again this year although W5IOU gave me a run for my money! QRN got the upper hand 2d nite. (Never got a log from W5IOU, Dick—*ed.*) *W5RSZ:* Heard YVLOB and JA1YAC but couldn't raise 'em. *W5LT:* Wish guys would listen to high end on even hours for 15 minutes. Same for high end boys. *K5MAT:* My new antenna much better than old one but still no durned good! *WA5ZKN:* Being my 1st contest I was surprised that I did as well as I did. My v.f.o. blew out on the 2d morning putting me out of the shindig early. Wait till next year! *W5RTQ:* Found condx generally poor. No Europeans heard this year. Was tempted to give XE2OK a phone call to get on so my country total would be 10! Was surprised to hear KH6IJ with the lousy condx.

W6KWE/6: Very pleased to work YV1OB, W4BRB/VP7, HR2HH, W9UCW/HKO and VS6DO for new countries on 160. Total now 18. I was surprised how early the East was coming thru. Heard KV4, YV, HKO, VP7 more than an hour *before* sunset. W3/4 peaked best in the 2 hours after sunset. (Tom, we have changed the ending time to 1600 GMT commencing next year so you west coast boys won't be done out of any trans-Pacific QSOs. How do you do it working VS6DO this year and HS5-

The first column indicates the number of contacts, second is the multiplier, third is the number of different countries worked and the last column is final score.

CONNECTICUT

K1PBW	265	67	24	60,300
W1WY	132	36	8	11,448
W1PPN	95	31	6	7,130
W4WFL/1	50	26	3	2,808
W0DRE/1	48	20	4	2,240
W1TX	38	18	6	2,088

MAINE

WA1IOG	51	23	4	2,898
W1DEO	24	16	4	1,024

MASSACHUSETTS

W1PL	101	31	7	8,512
W1HGT	35	27	19	6,426
W1BB	20	11	4	704

NEW HAMPSHIRE

W1FKF	39	17	2	1,326
W1SWX	15	11	3	418

RHODE ISLAND

W1HLY	36	13	1	936

VERMONT

W1TH	64	27	3	3,672

NEW JERSEY

W2FJ	210	56	14	30,688
W2EQS	178	46	8	19,320
W2TA	182	43	8	18,060
K2GAL	139	42	9	14,700
W2BP	83	38	8	8,740
W2KHT	100	35	6	8,120
W2AQT	73	22	5	4,092
WB2OZW	59	22	4	2,948
WA2HPB	32	10	2	640
W2HUG	11	10	6	540
W2IU	10	7	3	252
W2BAY	2	2	1	8

NEW YORK

WB2DXL	80	31	6	5,952
W2AGQ	73	29	3	4,860
K2GNC	31	24	10	3,216

DELAWARE

W3NNK	112	38	7	10,336

MARYLAND

W3IN	264	60	16	40,800
W3GN	174	40	5	14,880
W3FA	44	20	3	1,920
W3FSP	21	11	2	550

PENNSYLVANIA

W3AJS	133	32	4	9,024
W3WGH	111	35	6	8,890
W3QOR	75	28	5	4,872

ALABAMA

W4AUP	21	14	3	650

FLORIDA

WA4PXP	261	63	15	42,966
WA4DRU	117	39	11	12,970
K4BHG	124	41	8	12,792
W4DFU	74	32	6	5,760

GEORGIA

W6LQI/4	34	24	4	2,016

KENTUCKY

W4YOK	85	33	2	5,610

NORTH CAROLINA

W4TMR	120	42	5	11,340

SOUTH CAROLINA

K4DBV	150	47	10	17,108

TENNESSEE

W4HYY	115	41	7	11,070
W4UD	85	32	4	5,952
W4OQA	56	23	2	2,760

VIRGINIA

WA4RGH	100	34	8	8,636
W4ZM	91	32	4	6,016
W4KMS	23	12	2	552

ARKANSAS

WA5PGZ	3	3	1	18
WA5REU	2	2	1	8

LOUISIANA

K5TFG	194	52	12	24,752

MISSISSIPPI

W5RUB	153	48	7	16,992
K5MZU	80	27	2	4,320

NEW MEXICO

W5RSZ	159	45	6	16,470
W5LT	133	43	4	11,892
K5MAT	71	33	4	5,214
W5RE	9	8	1	128

OKLAHOMA

WA5ZKN	56	22	1	2,464

TEXAS

K5LIW	205	51	9	24,174
W5RTQ	194	51	9	22,644
W5SBX	163	49	10	19,502
W5JKD	90	32	2	5,760
W5FIX	45	24	3	2,352

CALIFORNIA

W6KWE/6	230	54	12	33,048
W6YRA	156	44	8	17,952
W6ITY	151	45	8	17,190
K6DDO	130	38	7	12,616
W6GWQ	104	35	6	8,960
W6AMO	106	36	6	8,872
W6NJU	70	35	6	6,300
W6AJJ	61	25	8	4,250
WA6HMT	60	20	2	2,400
W6JTB	55	15	2	1,650
W6EIG	50	14	2	1,400
W6MTJ	40	14	2	1,120
W6ZOL	28	15	3	960
K5MHG/6	3	2	1	12

ARIZONA

K7NEQ	94	40	6	8,800

IDAHO

W7DY	45	26	3	2,548
W7IWU	53	22	2	2,332

MONTANA

W7GBL	56	22	2	2,464
W7MKB	42	16	2	1,344

NEVADA

W7OK	88	30	4	5,760

OREGON

W7AVV	105	37	8	10,434

UTAH

K7RAJ	205	49	5	20,972
W7ZC	120	42	6	11,424
VE4AH/W7	93	33	4	6,930

WASHINGTON

W7FIM	51	15	2	1,530

WYOMING

W6JHV/7	125	46	6	14,076

OHIO

K8SJU	195	51	8	22,746
K8CCV	111	38	4	9,348
W8BDO	75	33	7	6,270

ILLINOIS

W9DL	283	60	11	38,760
W9YYG	221	54	9	26,892
W9PNE	161	54	10	20,736
K9IFO	137	42	4	12,180
WA9UET	92	32	5	6,656
W9ABA	33	12	1	792
K9ORP	5	5	1	50

INDIANA

W9BF	197	44	5	18,744
WB9BUV	79	32	5	5,824
W9DPL	50	28	2	3,024

WISCONSIN

W9VZP	199	46	5	20,148
WA9GYF	10	7	1	140

COLORADO

WA0CVS	117	34	2	7,956

IOWA

W0NFL	212	58	12	28,768
WA0TVD/0	150	47	8	16,356
W0II	57	30	2	3,660
W0BQ	36	23	2	1,656

KANSAS

W0PSF	201	53	8	24,698

MINNESOTA

W0AIH	188	50	6	20,400
W0RHI	80	30	2	4,800

MISSOURI

WA0RDJ	150	53	10	18,497
W0BV	104	41	3	8,856

NEBRASKA

W0VEA	33	19	1	1,254

NORTH DAKOTA

W0SDN	65	33	4	4,818

SOUTH DAKOTA

K8EEG/0	163	51	8	19,074
W0IT	86	34	2	5,848
K0UDZ	44	20	2	1,760
WA0OML	35	23	2	1,610

NEWFOUNDLAND

VO1FB	21	8	8	1,616

NEW BRUNSWICK

VE1ASJ	43	17	3	1,870

NOVA SCOTIA

VE1ZZ	31	17	9	2,414

QUEBEC

VE2IL	14	11	3	396
VE3BMV	204	44	7	20,064
VE3DU	20	14	2	560

SASKATCHEWAN

VE5XU	83	31	3	5,394
VE5QB	33	20	2	1,320
VE5UJ	32	16	2	1,024
VE5DT	1	1	1	2

ALBERTA

VE6MC	13	10	2	260

BRITISH COLUMBIA

VE7AKI	78	25	3	4,300
VE7HQ	37	12	3	1,224

N.W.T. (YUKON)

VE8OK	6	4	2	48

ASCENSION ISLAND

ZD8AY	8	6	6	270

AUSTRALIA

VK6NK	3	3	2	66
VK3RJ	12	2	2	58
VK3QI	8	2	2	38
VK3XB	8	2	2	38
VK5KO	3	2	2	18

AUSTRIA

OE1KU	85	8	8	3,376

BERMUDA

VP9BO	91	35	7	30,590
VP9GR	97	29	5	27,608

BRAZIL

PY1MGF	12	7	3	693

CURACAO

PJ2VD	70	33	10	21,780

CZECHOSLOVAKIA

OK1ATP	158	19	15	12,179
OK2BOB	175	16	16	10,544
OL5ALY	177	13	13	8,645
OK1AUT	156	13	12	7,631
OK1KRS	171	10	10	6,540
OK1KYS	118	10	10	4,130
OK2HI	110	11	11	4,004
OL1AOH	118	10	10	3,950
OK1AES	116	9	9	3,636
OK1DKR	113	10	10	3,620
OK2VX	96	11	11	3,432
OK1DIM	86	11	11	3,410
OL6AOQ	100	9	9	2,853
OK1DVK	97	9	9	2,826
OK1FAR	76	10	10	2,450
OK3YCF	85	9	9	2,340
OK1FAF	76	9	9	2,178
OK2PDN	77	9	9	2,088
OK1DOW	74	8	8	1,856
OK2SIX	75	8	8	1,752
OK1ASG	62	8	8	1,664
OK3KWO	64	8	8	1,576
OK1HAS	55	9	9	1,557
OK3TOA	50	9	9	1,495
OK2PEX	66	8	8	1,488
OK2PAW	67	7	7	1,421
OL0ANV	73	7	7	1,393
OK3CCC	59	7	7	1,267
OK2BNW	59	6	6	1,032
OK3TBY	57	6	6	1,026
OL0ANU	53	6	6	852
OK2BCI	40	7	7	819
OK1ATX	30	5	5	740
OK1MX	37	7	7	714
OK3YCL	39	6	6	702
OK3TQQ	36	6	6	630
OL1AMR	34	6	6	542
OK5VSZ	40	5	5	535
OL7AOC	38	5	5	500
OK2PDJ	34	5	5	490
OK1HBT/P	15	4	4	168
OL7AOF	27	2	2	120
OK1AQK	16	2	2	70
OK2BFX	16	2	2	70
OK3CDN	15	2	2	66
OK1KWP	8	1	1	16
OL5AMA	2	1	1	4

EIRE

EI9J	99	15	11	7,755

ENGLAND

G3VRW	193	15	15	9,585
G3HZL/A	169	14	14	7,504
G3XTT/A	164	11	11	5,907
G2DC	129	10	10	4,260
G3XWZ	112	8	8	2,736
G3NT	41	6	6	654

FINLAND

OH2BR	47	7	7	1,589
OH2BAD	28	7	7	959
OH2BH	2	2	1	4

GERMANY

DL8AM	160	12	12	9,204
DJ6TK	105	11	11	5,720
DJ2XP	104	10	10	4,930
DJ2YE	12	5	5	245

HAWAII

KH6IJ	56	22	4	11,022

HONDURAS

HR2HH	44	19	5	9,960

HONG KONG

VS6DO	3	2	2	60

ISLE of MAN

GD3HQR	7	3	3	69

JAPAN

JA7AO	25	5	5	315
JA3AA	23	4	4	272
JH1LKH	15	3	3	123
JA7COI	11	2	2	50

NETHERLANDS

YV1OB	74	35	9	23,175

NORTH IRELAND

GI3WSS	38	8	8	1,496

OGASAWARA ISLANDS
(Bonin & Volcano Is.)

JD1ABH	6	1	1	30

OKINAWA

KR8AG	13	1	1	65

PERU

OA8V	4	4	3	120

ST. KITTS

VP2KX	1	1	1	5

SCOTLAND

GM3IGW/A	187	17	15	15,997
GM3YCB	179	15	15	13,110

SWITZERLAND

HB9NL	80	16	14	6,752
HB9CM	33	10	7	2,100
HB9UD	33	7	7	1,155
HB9QA	25	5	5	610

TRINIDAD

9Y4NN	21	15	5	2,850

TRISTAN da CUNHA

ZD9BM	2	2	2	20

VENEZUELA

YV1OB	74	35	9	23,175

VIRGIN ISLANDS

KV4FZ	220	64	24	134,488

WALES

GW3GWX	65	9	9	2,817

MULTI-OPERATOR

NEW JERSEY

WA2KWB/2	144	38	6	12,160

MARYLAND

K3RUQ	216	52	10	22,516

NEW MEXICO

K5FIQ	115	39	5	9,906

TEXAS

K5SOR	90	37	6	7,844

CALIFORNIA

WB6QNG	60	21	2	2,520

NEVADA

W7DIM	6	3	1	36

WASHINGTON

W7YGN	181	45	7	20,340
WA7ILC	109	35	8	12,040

MICHIGAN

K8VQP	202	47	7	20,868
K8BYI	220	41	6	19,352
W8TZZ/8	139	40	6	12,400
W8MAI/8	136	40	5	11,840
W8HFM	41	14	2	1,148

WEST VIRGINIA

W8VVE/8	130	35	7	14,280

ILLINOIS

W9DY/9	226	53	8	26,924
WB9AWY	180	54	10	22,996
W9AML/9	148	42	5	13,440

BAHAMA ISLANDS

W4BRB/VP7	272	56	9	149,632

ENGLAND

G3WPO/A	192	13	13	7,787

HAWAII

KH6HCM	34	12	4	3,612

JAPAN

JA1YAC	28	6	6	918

NETHERLANDS

PA0PN	149	16	13	12,272

SAN ANDRES

W9UCW/HK0	166	53	15	84,270

SCOTLAND

GM3KMR/A	161	14	14	10,780
GM3LWS/A	171	11	11	9,086

Here is Guri, VE3BMV, a newcomer to the band on this side of the Atlantic. He has been in contest before, though, as OK3BU. He was in extreme eastern OK land.

ABD last year?—*ed.*) *W6AMO:* Thanks for another FB Contest. It's always a pleasure. I worked a total of 26 W6 stations actively working in the test. How many logs from W6 will you receive? Probably no more than 7 or 8. (You're wrong, Ken. Received 14 but that is still very poor when there was a total of 69 W/K6s on—*ed.*)

WA7ILC: Terrific fun! And the DX (W9UCW/HKO, KV4FZ, W4BRB/VP7) was beyond wildest expectations. Did it all with a lil ōle Ranger. Only east coast sigs heard were K1PBW, W3IN, WA4PXP, W4YWX. CU next year! *K7NEQ:* So excited about KH6 QSO I missed sending O41 to next station worked. Fell out of my chair when KV4FZ called me. Maybe someday will hear Europe. *W7DY:* Condx were fairly good although no stations north of the Mason-Dixon Line and east of Ohio were ever heard. I think that this is my last year to play in the contests since I am amused by earning multipliers and not at all by the gross number of contacts. *W7IWU:* Poor antenna. Just a 180′ lw series tuned. *W7GBL:* Used 2 off-center-fed Hertz antennas one being 250′ long and 60′ high, the other 66′ long and 50′ high.

K8SJU: When I took Julius, K8HKB, to the airport for his trip to San Andres for the contest, he looked neat and clean cut, suit, tie, shaved, etc. When I picked him up, no tie, no shave plus quite a bit browner. Seems he had a lot of fun but everytime except once someone else was at the operating position at HKO when I QSOd them. Where, oh where, was Julius? He claims he is going back next year and is trying to get me to go along. P.S.: I have an XYL; he doesn't. *K8CCV:* Saddest story. Rig blew up, antenna fell down, receiver acted up, clock slow—started test 1 hour late—and power line noise. Whew! *K8BYI:* Well, here we are again trying to win the state of Michigan! Boy, this year we had a pretty bad mess of QRN. Heard a lot of DX but fewer states. Don't think we did very good—too little multiplier.

W9DY: Condx especially good the 1st nite. Our location a bit noisy so we couldn't always copy as far as we could transmit. Worked everything we could hear but unfortunately no Europeans were heard. Suggest clarification on how many multipliers a KH6 or KL7 would merit. *W9AML/9:* Please publish the Central Illinois Radio Club's thanks to the operators who braved the zero and sub-zero at our tower site for 30 hour coverage in the contest. *W9DL:* QRN the 2d nite deafening and frustrating. Never heard a European station. Heard 3 stations sending numbers to HR2HH at the same time. Worked all States except KL7. *W9PNE:* Best DX heard: G3SED, KH6IJ. Best worked, PY1MGF. *K9IFO:* Condx were fair to poor here. Antenna was a 45′ vertical which wasn't quite as good as the 1/2 wave Windom I had last year. *W0NFL:* Biggest thrills, working PY1MGF and KH6IJ for State #46. Disappointments: I missed 9Y4NN and worked only 6 W1s. I just couldn't hear them whereas west coast, Florida and signals from VP7, HKO, YV, KV4, etc. were FB. *WA0TVD/0:* 1st nite at 4 P.M. local time was ready to set up gear under big tower. Completely homebrewed a commercial rig for 160 in 5 hours. Got late start. W0NFL continued to hold lead. Signals on long haul (except Europe) were VY FB on BC tower. W4BRB/VP7 peaked 599 plus 20 once. Worked 1st KH6 (KH6IJ) on 160. Wish we could have contest few weekends prior when had opening to Eu. Heard GM3YCP on s.s.b. then! *W0II:* I might ask, where were the W1's, W2's and VE's? I guess they were there but buried under the W8 and W9 sigs on the low end. What a QRM situation. Even the 75A-2 with the 500 cycle filter couldn't seem to dig them out.

Canada

VO1FB: QRN very severe. Called many W/K stations. Didn't even work my own country. My lowest score yet. *VE1ASJ*: Always enjoy a *CQ* WW Contest. Heard ZD9BM, ZD8AY, W9UCW/HKO, YV1OB, PY2BJH, KV4FZ and W4BRB/VP7. *VE1ZZ:* Heard ZD8AY. *VE2IL:* Contest started well but had considerable trouble with rig and finally called it quits. Was surprised at great big signal that W9UCW/HKO was putting in here. Also heard VP2 and, of course KV4FZ. Worked VP7 for a new one. Rig here runs 18 watts to a 90′ end fed antenna. *VE3BMV:* When I received log forms from you I couldn't resist so ordered xtal for 160 for my Yaesu FTDX-400 and modified it. Pleased to work fine DX stations especially HKO. Sorry I didn't get TF, HR, PY, PJ which I heard. Finally got KV4FZ. In 1969 I called him 2 hours. He was 589 in OK3 land. (Yuri is ex-OK3BU and was very active over there on 160-*ed.*). *VE3DU:* Condx sure left much to be desired. We had our 2d blizzard of the week on that Friday nite with winds up to 60 mph and low temperatures. London, Ontario had a very rough week with about 2′ of snow and drifts all over the place. Rig conked out on me about 0215Z. *VE5XU (ex-VE2UQ):* Great to be back on 160. No east coast heard but 3 nites later band wide open to east! *VE5QB:* I had a lot of fun in the contest and am already looking forward to next one. Enjoy amateur radio more than most hams since I'm physically handicapped. I'm a victim of multiple sclerosis. I didn't take part in the contest with idea of winning but rather to give points to the stations as I heard them. *VE5UJ:* Band condx not quite what they've been other years. Didn't hear much from the east coast. *VE6MC:* My 1st 160 c.w. contest in Canada. (ex-G3LXG). Band was only open from about 04 to 09 GMT. *VE7AKI:* Enjoyed the contest as usual. Receiving condx quite good, noise level very low and heard lots of DX but couldn't raise many outside of local W6/W7. Even an easy one like WOAIH couldn't hear me—hi! *VE7HQ:* Managed to get the inverted Vee up in time and worked my first KH6's on 160—4 of them—and got good reports with my 25 watts. Heard two JA's but couldn't raise them with my QRP. It was just before sunrise here and my antenna not in the best direction. Maybe next year! Many thanks for a very interesting contest. *VE8OK:* Day before contest was warmest day to put up antenna—only 40 below. Was it worth it? Heard W1BB, K1PBW, KH61J and many Texas and California stations loud and clear but couldn't get thru the QRM. Had to work 2d nite. Sorry for only 6 contacts. (Don't apologize at all. Terry. We were delighted to have VE8 on for the 1st time and hope you'll be with us again in '72.-*ed.*).

DX DX DX DX DX DX

ZD8AY: Many thanks for sending me the contest log sheets. They arrived the day before the contest (29 January) after forwarding from U. K. Last year I was on as GW3UPK. Condx during this year's contest were disappointing as a few days earlier I. had worked G,

[*Continued on page 86*]

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RF TUNE
NB
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AF GAIN
IF BW kHz
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RF GAIN
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TED HENRY (W6UOU) **BOB HENRY** (W0ARA) **WALT HENRY** (W6ZN)

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DX

FLASH !

The FCC has received notice from Cambodia that pending government approval and ITU notification, there would be no objection to communication between XU1AA at Phnompenh and US amateurs.

BY JERRY HAGEN,* WA6GLD
ASSISTANT DX EDITOR

AFTER several years of endeavor, *CQ* DX Editor K4IIF has asked for a month off, so your WPX/DX Award Manager will try to generate a column as interesting as those from John. As Award Manager many compliments are received on the fine *CQ* DX column and the DX fraternity is fortunate to have the talent of Mr. Attaway.

As this issue arrives, the *CQ* WW Phone Contest will be past history, with *CQ* DX Editor John recuperating from operation at VP5JA while Assistant DX Editor Jerry hopes to be resting from effort in 6Y5 land. Hopefully conditions will be excellent for a big *CQ* WW C.W. Contest. Judging from summer and early fall conditions 20 and 40 meters will have to bear the brunt of heavy activity with the decline of sunspots and the 28 and 21 mc bands. Those working on 5 Band DXCC should have a good winter on 7 and 3.5 mc and even 160 Meters.

John, YB0AAH and Jay, W6FAY meet in Djakarta earlier this year. Jay will be remembered for his W6FAY/KP6 and KP6AZ activity of the mid sixties.

Comment on Country and Prefix Status

There are often questions regarding country status for the *CQ* DX Awards and for prefixes on the WPX Awards. In a poll of the *CQ* DX Committee several years ago it was felt that *CQ* should use the ARRL Country List for its awards to encourage uniformity in the definition of a country. Since that time many DXers say that they can not take pride in a QSO with a "sandbar" such as Blenheim or Geyser Reef, even though the operator experienced great risk to provide a multitude of contacts. At the same time others feel that new countries provide the old time DXer a spark of life for DXCC, and DX activity is always better when important DXpeditions are taking place.

If one looks at the DXCC list carefully and has followed DXing seriously for a number of years it is easy to see that "The List" is a complex document embodying politics, human nature and geography. Questions such as a split of the Germanys, the status of Zan-

The CQ DX Award Program

C.W. DX

66......WA2HZR
67......WA3CSF
68......W3QDV

S.S.B. DX

152......G5GH
153......DJ2UU
154......W0SQD
155......I1AA
156......WA3LRJ
157......W9OKL
158......W4GIW
159......W4FUM

CQ DX Endorsements

CW: W0SFU—250, WA2HZR—28 MHz.
SSB: I1AA — 300, K9LUI — 275, K0WWX, W4FUM—250, K6SSN—200, WA2FLA — 150, WA2FLA, DJ2UU, W9OKL, W4GIW—28 MHz.

Complete rules for the CQ DX Award Program may be found on pg. 58 of the January, 1971 issue. Application blanks and copies of the rules may be obtained by sending a self-addressed, stamped envelope to the Award Manager, P.O. Box 1271, Covina, Cal. 91722, or to the DX Editor.

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*P.O. Box 1271, Covina, Calif. 91722

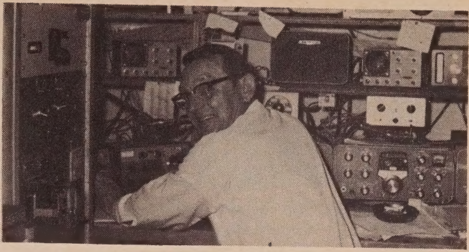
zibar and unclaimed or multi-claimed territory can generate much thought. About the only DXCC administration changes that could be made easily are those of the following type:

1. Do not credit "Country Status" to any un-claimed territory.

2. Make the 500 mile water separation retro-active to all countries on the DXCC list. (At present 250 miles is the separation requirement for a country of the same administration which was on the country list before May 1, 1963. This might eliminate several long-time countries, however the limit would be uniform for all countries on the list.)

At this time there is no plan for *CQ* to publish its own country list as it is felt that the DXCC Advisory Committee should take this action if desired by DXers.

Believe it or not, the definition of a prefix is almost as difficult as that of a country! The basic prefix criteria is that the first 2 or 3 characters of the call constitute the prefix. In cases where there is no number the prefix consists of the first two letters and a zero. Thus, the call RAEM becomes RA0 and UPOL-12 is a UP0. Portable designators such as M, /MM, /P which are *not* issued to a country by the ITU are ignored for WPX. Thus HP9FC/MM counts for an HP9 and ZL3PO/C counts as a ZL3. Rule 4 states that a portable call would count only if it is the normal call for the area. Thus WF3IEC/4 counts for a W4 as WF4 is not the normal call for the fourth area! Within a call area a call such as WS2JRA/2 is counted as WS2 as it was issued for that area. Sounds confusing — well it confuses the WPX Manager at times! Any questions will be gladly answered when an s.a.s.e. is enclosed.



The West's foremost QSL Manager is Rubin, WA6AHF with assistance from XYL Ferne. QSL's for sixteen stations are currently handled with Ferne collecting the stamps of all kinds!

The WAZ Program

S.S.B. WAZ

907	WB9BGS	912	WA3IUV
908	OH2BAD	913	W9HJ
909	JA3LUK	914	WA3HGV
910	JA1HRQ	915	SP5BB
911	I1YV		

C.W.—Phone WAZ

3148	DK3QJ	3249	JA1DQT
3239	W9KYZ	3250	3B7DA
3240	WA9VGY	3251	WA4FFW
3241	OH2BR	3252	K6HCL
3242	PJ2VD	3253	OK1AMB
3243	W8MJE	3254	OK1APV
3244	W8FAW	3255	OK2BMF
3245	W3NNK	3256	SP8CNR
3246	WA3HRV	3257	SP8ARK
3247	VO2GD	3258	G3TOK
3248	K9PQG	3259	PY6FI

Phone WAZ

465......W1DO

Complete WAZ rules are shown on pgs. 64-66 of the June, 1970 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205. Winter Haven, Fla. 33880.

DXing from California

In the coming year it is hoped to have a brief synopsis of DXing from some of the various areas of the USA and possibly from Europe. For this task we will enlist the help of your *CQ* DX Advisory Committee members.

Although DXing from California can be considered as good, the W6 has the inherent disadvantage of being the least rare state and call area. Activity in the Greater San Francisco and Los Angeles areas provide stiff local competition and QRM. For the most

Julio, CR4BC is active on all 5 bands with this fine layout and a TH-6 Triband Beam. Julio is also known as a good QSLer!

WPX Honor Roll

The WPX Honor Roll is based on confirmed current prefixes which are submitted by separate application in strict conformance with the CQ Master Prefix List. Scores are based on the current prefix total regardless of an operators all-time prefix count.

MIXED

W4OPM	Joe Hiller	1100
VE3GCO	Garry Hammond	825
W8LY	Michael Bakos	822
W9WHM	John R. Leary	811
DJ7CX	Leonhard Poelt	808
K1SHN	Chuck Banta	808
W3PVZ	Joseph M. Olnick	802
DL1MD	Heribert Rechl	794
W8ROC	Frederick Riecks	781
ON4QX	Bob Berge	778
G3DO	D.A.G. Edwards	773
I6SF	Serafino Franchi	757
W4IC	George Mack	757
YU1AG	Djura Borosic	754
W0AUB	Bill Bergmann	752
CT1LN	Paulo J. S. Coelho Vieira	749
W4BQY	G. B. Fisher	741
K0BLT	Frank Cahoy	733
K8UDJ	Charles Hutchinson	712
WA6MWG	John Billon	708
W4CRW	Robert Sommer	701
WA5LOB	James Edwards	699
PY4AP	"Bill" Marra	685
SM7TV	Boris Goransson	674
WA6EPQ	Larry Brockmann	663

SSB

W4OPM	Joe Hiller	1025
W4NJF	Gay E. Milius	882
DL9OH	Karl Muller	783
HP1JC	Juan G. Chen	750
W9DWQ	Edward A. Goodbout	741
K2POA	Arthur B. Johnson	733
I8KDB	Giampaolo Nucciotti	718
I0AMU	Alfonso Porretta	715
W4IC	George A. Mack	702
WA5LOB	James D. Edwards	692
G3DO	D.A.G. Edwards	680
K1SHN	Chuck Banta	679
W0YDB	Bill Higgins	671
F2MO	Michel Dort	632
W3DJZ	Arden B. Hopple	620

CW

W4OPM	Joe Hiller	900
W8KPL	William W. Simpson	853
W8LY	Michael A. Bakos	837
VK3AHQ	Henry Denver	809
W2HO	W. Vollkommer	802
DL1QT	Helmut Baumert	780
W2AIW	Charles W. Rogers	776
ON4QX	Bob Berge	750
OK2DB	Jaroslav Dufka	693
DJ7CX	Leonard Poelt	680
WB2FMK	Robert J. Rasche	680
W9FD	W. W. Johler	680
W4IC	George A. Mac	662
K1SHN	Chuck Banta	653
G2GM	F. D. Cawley	647
YU1AG	Djura Borosic	636
I6SF	Serafino Franchi	622
VO1AW	Clarence Mitchell	605
VE4OX	D. E. McVittie	600

PHONE

CT1PK	Manoel F. DeAlmeida	894
CT1LN	John R. Leary	813
W9WHM	D. A. G. Edwards	761
G3DO	Gerrit Mulder	754
PA0SNG	Paulo J. S. Coelho Vieira	710
CX2CN	Samuel Barreiro	666
W3DJZ	Arden B. Hopple	654
I6SF	Serafino Franchi	635
OE2EGL	Eugene Goffriller	601

part, notable DXers are active members of the Southern and Northern California DX Clubs which have regular monthly meetings with good turn-outs.

This tropical QTH belongs to Clay, HS1ABU who has just received his third WAZ on 2XSSB after qualifying as XW8AS and KH6FBJ. Clay is also VP of the Society of Thai Amateur Radio.

W6's also have the reputation of having big beams and kilowatts, which in this editors opinion is somewhat exaggerated. However, due to propagation conditions being more difficult to Europe than anywhere else on the mainland, the large antennas and 2 kw PEP rigs are probably more popular than in other areas of the U.S. The serious country hunter in W6-land probably has a single-band 20-meter beam of 4 elements or larger. The Hy-Gain 204BA is probably the most popular model, with many 4 and 5 element home-brew yagi's made of irrigation aluminum tubing which is available due to the semi-arid climate. Those interested in multi-band activity are probably split between Hy-Gain TH-6DX tribanders or Triband 3 and 4 element quads. As there is little icing problem in the state, quads are increasing in popularity. There are several stations with multi-tower contest installations such as K6EBB and W6VSS as well as W6RR's and K6AHV's yagi's for all bands 40 through 10 meters. And of course the reknown rhombic farm of W6AM. The largest W6 antenna would probably rate as a toss-up between WA6ZZK's 12-element 20-meter yagi on a 156′ boom and W6VSS's 5-element 40-meter beam on a 100 foot boom. The W6 DXer also prides himself for snappy operation and Honor Roll operators such as W6TZD, W6WX, K6EV, and K6YRA have reached the top with modest triband installations.

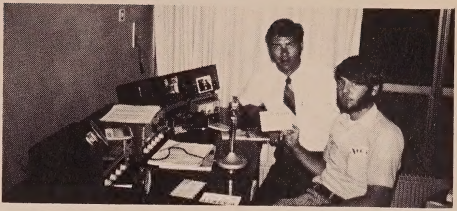
Most DXers consider the path over the north pole as the most difficult to work regularly and Californians are no exception. The great circle map centered on Los Angeles shows MP4, VQ9 and the Scandanavian areas to the north, ZS directly east, the Eastern Pacific south, and Perth, Australia directly west. Most W6's consider the mideast and Indian Ocean as the most difficult areas to work on all bands, however the 20-meter long path is very consistent to this area in the winter months.

Below is an examination of propagation conditions by band. Keep in mind that the state is over 1000 miles long and there is over 1/2 hour in sunrise/sunset variances between Northern and Southern California which slightly changes the times of openings.

10 & 15 Meters—The difficult area from W6 land is Zone 21, 22 and 39 areas which are over the north pole. Only during the high sunspot activity of 1969 were conditions open to these areas regularly. During the early summer months of '67, '68, '69 and '70 several long path openings to Zone 37, 38 and 39 were noted about 0500-0600 GMT (2200 hours Local). In 1969 the 21 mc band was open to Europe during W6 morning hours almost the entire year, with openings in local evening time during the spring and summer months. During the sunspot low of the mid '60's the most consistent propagation was to VK, South America and the Caribbean. It was virtually impossible to work Europe on 28 mc during this time period.

20 Meters—Conditions on 20 meters are similar to those noted for 15 and 10 however the predominance of long path openings make this band more complex to analyze. Generally speaking, higher sunspot activity produced more long path openings. During the higher sunspot years the 1500 GMT (7 A.M.) LP openings to Europe and the mideast were in evidence around the year, however, this opening limited to wintertime months during sunspot lows. The beam heading for this opening is over New Zealand which gives

[*Continued on page 88*]



John, K3AFO (l.) visits John, SV0WOO in Athens. (Photo via K3AFO.)

The WPX Program

S.S.B. WPX

637......W9KDX
638......W8UMR
639......I1AA
640......IS1AEW
641......ZL1BDW

C.W. WPX

1121......SP9ABE
1122......SP8CNR

Mixed WPX

299......W4HHN
300......DL7GK

VPX

37......SM4-3964

WPX Endorsements

S.S.B.: W4OPM — 1100, W9DWQ — 800, I1AA—650, W8GKM, VO1AW, CT1LN — 600, K2POA, CR7IK, W6ZC — 450, KC6WS, WA6INK — 350, W4WWD, G3TLV — 300, WB6KGG — 250.

C.W.: DJ7CX — 700, K7ABV, W8UMR — 650, OK3BT, DJ3LR — 450, VE1MF, W6CLM, SP9ABE—400, WA1CYT—350.

MIXED: DJ7CX—800, CT1LN, W8UMR—750, K8UDJ, PY4AP—700.

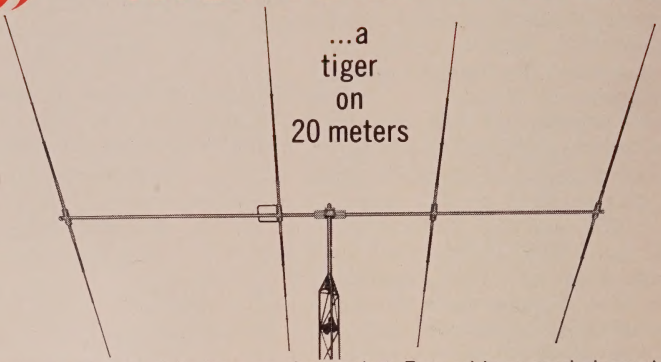
PHONE: CT1LN—700, W4WSF—550.
80 Meters: CT1LN, K8UDJ, SP9ABE.
40 Meters: K8UDJ, DJ7CX.
20 Meters: W4WSF, K8UDJ.
15 Meters: W4CRW, K8UDJ.
10 Meters: DJ7CX.

Africa: K8UDJ.
Asia: W8UMR, K8UDJ.
Europe: DK2BM, IS1AEW.
North America: W4CRW, DJ7CX.
Oceania: W8UMR, K8UDJ, WA6TAX.
South America: K2OLG, K8UDJ.

Complete rules for WPX, WPNX, and VPX may be found on pgs. 66-67 of the June, 1970 issue. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to Award Manager, P.O. Box 1271, Covina, Cal. 91722, or to the DX Editor.

for the most advanced antennas under the sun!

HY-GAIN 204BA MONOBANDER



The best antenna of its type on the market. Four wide spaced elements (the longest 36′6″) on a 26′ boom along with Hy-Gain's exclusive Beta Match produce a high performance DX beam for phone or CW across the entire 20 meter band.

- 10 db forward gain
- 28 db F/B ratio
- Less than 1.05:1 SWR at resonance
- Feeds with 52 ohm coax
- Maximum power input 1 kw AM; 4 kw PEP
- Wind load 99.8 lbs. at 80 MPH
- Surface area 3.9 sq. ft.

The 204BA Monobander is ruggedly built to insure mechanical as well as electrical reliability, yet light enough to mount on a lightweight tower. (Recommended rotator: Hy-Gain's new Roto-Brake 400.) Construction features include taper swaged slotted tubing with full circumference clamps; tiltable cast aluminum boom-to-mast clamp; heavy gauge machine formed element-to-boom brackets; boom 2″ OD; mast diameters from 1½″ to 2½″; wind survival up to 100 MPH. Shipping weight 51 pounds.

See the best distributor under the sun...the one who handles the Hy-Gain 204BA Monobander.

Model 204BA (4-element, 20 meters)...........................	**$149.95**
Model 203BA (3-element, 20 meters)...........................	**$139.95**
Model 153BA (3-element, 15 meters)...........................	**$ 69.95**
Model 103BA (3-element, 10 meters)...........................	**$ 54.95**

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Propagation

BY GEORGE JACOBS,* W3ASK

According to daily observations made of the sun at the Zurich Solar Observatory, a monthly mean sunspot number of 60 was reported for August, 1971. This results in a smoothed running sunspot number of 76, centered on February, 1971.

The solar cycle continues to decline at a relatively rapid rate. This month's propagation forecast is based on a predicted smoothed sunspot number of 54, centered on December, 1971. Last year at this time the solar index was 82.

Solar activity has now declined to a point where some noticeable changes will take place in DX openings during this winter season, when compared to past winter seasons during periods of more intense solar activity.

For example:

F-layer DX openings on 6 meters are now very unlikely

Fewer DX openings will be possible on 10 meters

DX openings on 20 meters during the hours of darkness will be reduced considerably

Conditions will *improve* for DX openings during the nighttime hours on 40, 80 and 160 meters.

During December, the 10 meter band should open an hour or so after sunrise, peaking on signals from an easterly direction before noon; from a southerly direction during the afternoon hours; and from a westerly direction during the late afternoon and early evening hours.

Excellent openings are expected on the 15 meter band, to one area of the world or another, from shortly after sunrise through the early evening hours. This should be the optimum band for DX openings during much of the daylight period.

Good-to-excellent DX propagation conditions are forecast for 20 meters during December. Opening at sunrise, the band is expected to remain open to one area of the world or another through the daylight hours and into the early evening. To some areas of the world, 20 meters may remain open during many of the hours of darkness as well. DX propagation conditions should be optimum on this band during and shortly after local sunrise, and again during the late afternoon and early evening hours.

LAST MINUTE FORECAST

October, 1971

Days	*Rating & Forecast Quality* (4)	(3)	(2)	(1)
Above Normal: 6, 11, 13, 19, 26-27			B-C	C
Normal: 1-2, 5, 7, 9-10, 12, 14, 16, 18, 20-21, 25, 28-29	A-B	B-C	C-D	D-E
Below Normal: 3-4, 8, 15, 17, 22, 24, 30-31	C	D	D	E
Disturbed: 23	D	E	E	E

How To Use These Charts

The following is an explanation of the symbols shown above, and instructions for the use of the *CQ* propagation predictions:

1—Enter Propagation Charts on following pages under appropriate band and distance or geographical area columns. Read predicted times of band openings at intersection of both columns.

2—Following each predicted time of band opening is a forecast rating which indicates the relative number of days the band is expected to open during each month of the forecast period. The higher the rating, the more frequent the opening, as follows: (4) band open more than 22 days each month; (3) between 14 and 22 days; (2) between 8 and 13 days; (1) less than 7 days.

On the "Short-Skip" Chart where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. Note the forecast rating for later use.

3—With the forecast rating noted above, start with the numbers in parenthese at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating higher than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following meaning: (A—excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak and considerable fading and noise; E—poor opening, or none at all.

4—This month's DX Propogation Charts are based upon a transmitter power of 250 watts c.w.; 1 kw p.e.p. s.s.b., or 1000 watts d.s.b., into a dipole antenna a quarter-wave above ground on 160 and 80 meters a half-wave above ground on 40 and 20 meters, and a wave-length above ground on 15 and 10 meters. For each 10 db gain above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss, reception will become poorer by one level.

5—Local Standard Time for these predictions is based on the 24-hour system.

6—The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4 and KV4 amateur call areas; The Central USA Chart in the 5, 9, and 0 areas, and the Western USA Chart in the 6 and 7 areas. The charts are valid from Dec. 15, 1971 through Feb. 15, 1972 and are prepared from asic propagation data published monthly by the Institute For Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado.

DX propagation conditions on the lower frequency amateur bands should improve considerably during December and the winter months. Static levels should be at seasonally low values, and signal levels are expected to be stronger than at any other time of the year. DX openings on 40 meters should begin during the late afternoon hours, with the band opening first to Europe and to other areas in a northeasterly direction from the USA. The band is expected to remain open to one area of the world or another through the hours of darkness and until shortly after sunrise, when conditions are expected to peak to Oceania and to other areas in a generally southerly and westerly direction.

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*11307 Clara Street, Silver Spring, Md. 20902

DX conditions on 80 meters should be fairly good during December. Relatively strong-signal openings should be possible to many areas of the world during the hours of darkness, with conditions expected to peak as the sun rises at the easternmost terminal of a DX path.

Even the 160 meter band should have its share of DX during December. Some openings are likely to take place when the transmission path is entirely in darkness, or when part of the path is in darkness and the other in either twilight or dawn.

V.H.F. Ionospheric Openings

Trans-equatorial scatter, or TE openings on 6 meters are expected to fall off a bit in the northern hemisphere during December, but some openings may be possible between the southern half of the USA and South America. TE openings take place during the evening hours, peaking between approximately 8 and 11 P.M. at the path mid-point.

A secondary seasonal peak in sporadic-E propagation is expected during December (the major peak occurs during the summer months). This should result in a number of good short-skip type openings on the 6 meter band, between distances of about 800 and 1400 miles. Sporadic-E conditions usually peak during the early evening hours, but some openings may occur at other times as well.

Two significant meteor showers are expected during the month, which may make possible some meteor-scatter type openings on 6 meters, and perhaps on 2 meters as well. *Geminids,* classified as a major shower, should begin on December 13 and last for about three days. The shower's maximum intensity is expected to take place at approximately 9 A.M. EST on December 14, with a meteor rate of about 50 an hour. *Ursids,* a less intense and shorter duration shower, is expected December 22-23. Peak intensity should take place at about 3 A.M. EST on December 23, with a rate of approximately 15 meteors an hour.

Some auroral-type v.h.f. ionospheric openings are also likely to occur during December, especially during periods when ionospheric conditions on the h.f. bands are below normal or disturbed. Check the "Last Minute Forecast" at the beginning of this column for the days that are most likely to be in these categories during the month.

This month's column contains DX Propagation Charts valid from December 15, 1971 through February 15, 1972. Short-skip Propagation Charts for use during December appeared in last month's column.

The Editor of this column would like to take this opportunity to extend his warmest wishes to everyone, everywhere, for a Merry Christmas and a very Happy New Year.

73, George, W3ASK.

December 15, 1971-February 15, 1972

Time Zone: EST (24-Hour Time)

EASTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	08-09 (1) 09-10 (2) 10-12 (1)	07-08 (1) 08-09 (3) 09-11 (4) 11-12 (3) 12-13 (2) 13-15 (1)	05-06 (1) 06-07 (2) 07-09 (4) 09-11 (2) 11-13 (3) 13-14 (4) 14-15 (3) 15-17 (2) 17-19 (1)	14-16 (1) 16-17 (2) 17-19 (3) 19-00 (4) 00-03 (3) 03-04 (2) 04-05 (1) 17-19 (1)* 19-20 (2)* 20-02 (3)* 02-03 (2)* 03-04 (1)*
Northern Europe & European USSR	08-11 (1)	07-08 (1) 08-11 (2) 11-13 (1)	05-07 (1) 07-09 (3) 09-12 (2) 12-16 (1)	16-19 (1) 19-23 (2) 23-03 (1) 19-02 (1)*
Eastern Mediter-ranean & Middle East	08-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-11 (2) 11-13 (1)	23-02 (1) 05-07 (1) 07-09 (2) 09-11 (1) 11-13 (2) 13-15 (3) 15-16 (2) 16-18 (1)	18-20 (1) 20-22 (2) 22-00 (1) 20-23 (1)*
Western & Central Africa	08-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-16 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	01-03 (1) 06-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-17 (4) 17-18 (3) 18-19 (2) 19-21 (1)	18-22 (1) 22-02 (2) 02-03 (1) 00-02 (1)*
East Africa	08-10 (1) 10-12 (2) 12-14 (1)	07-10 (1) 10-12 (2) 12-14 (3) 14-15 (2) 15-16 (1)	07-13 (1) 13-15 (2) 15-18 (3) 18-20 (2) 20-21 (1)	18-00 (1)
South Africa	08-09 (1) 09-10 (2) 10-12 (3) 12-13 (2) 13-14 (1)	07-09 (1) 09-12 (2) 12-14 (3) 14-16 (2) 16-17 (1)	06-09 (1) 12-14 (1) 14-15 (2) 15-17 (3) 17-19 (2) 19-22 (1) 22-01 (2) 01-02 (1)	18-19 (1) 19-21 (2) 21-00 (1) 19-22 (1)*
Central & South Asia	08-10 (1) 17-19 (1)	08-10 (1) 17-19 (1)	06-07 (1) 07-09 (2) 09-12 (1) 18-22 (1)	06-08 (1) 20-22 (1)
Southeast Asia	08-10 (1) 18-20 (1)	08-11 (1) 17-20 (1)	06-07 (1) 07-09 (2) 09-12 (1) 19-23 (1)	06-08 (1) 20-22 (1)

*Predicted times of 80 meter openings. Openings on 160 meters are also likely to occur during those times when 80 meter openings are shown with a forecast rating of (2), or higher.

Far East	17-19 (1)	16-17 (1) 17-19 (2) 19-20 (1)	05-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-22 (2) 22-00 (1)	05-08 (1) 05-07 (1)*
South Pacific & New Zealand	12-14 (1) 14-16 (2) 16-18 (1)	10-14 (1) 14-16 (2) 16-18 (3) 18-20 (2) 20-21 (1)	06-07 (2) 07-09 (3) 09-11 (2) 11-19 (1) 19-23 (2) 23-06 (1)	01-02 (1) 02-04 (2) 04-07 (3) 07-08 (2) 08-09 (1) 04-05 (1)* 05-07 (2)* 07-08 (1)*
Australasia	09-11 (1) 16-18 (1)	08-12 (1) 14-16 (1) 16-20 (2) 20-21 (1)	06-07 (1) 07-09 (3) 09-10 (2) 10-14 (1) 14-16 (2) 16-19 (1) 19-22 (2) 22-02 (1)	03-05 (1) 05-07 (2) 07-09 (1) 05-08 (1)*
Northern & Central South America	07-09 (1) 09-11 (2) 11-14 (3) 14-16 (2) 16-18 (1)	07-08 (1) 08-11 (3) 11-13 (2) 13-16 (4) 16-17 (3) 7-18 (2) 18-20 (1)	02-06 (1) 06-07 (2) 07-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-02 (2)	17-18 (1) 18-19 (2) 19-21 (3) 21-04 (4) 04-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-22 (2)* 22-02 (3)* 02-04 (2)* 04-06 (1)*
Brazil, Argentina, Chile & Uruguay	08-11 (1) 11-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-18 (2) 18-19 (1)	13-14 (1) 14-15 (2) 15-17 (3) 17-19 (4) 19-21 (3) 21-02 (2) 02-06 (1) 06-08 (2) 08-10 (1)	19-21 (1) 21-02 (2) 02-05 (1) 21-03 (1)*
McMurdo Sound, Antarctica	*Nil*	07-10 (1) 14-16 (1) 16-18 (2) 18-19 (1)	17-19 (1) 19-20 (2) 20-23 (3) 23-01 (2) 01-04 (1)	00-05 (1)

Time Zones: CST & MST (24-Hour Time)

CENTRAL USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	08-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-12 (2) 12-14 (1)	05-07 (1) 07-09 (3) 09-11 (2) 11-13 (3) 13-15 (2) 15-17 (1) 21-00 (1)	15-17 (1) 17-18 (2) 18-23 (3) 23-02 (2) 02-03 (1) 17-20 (1)* 20-01 (2)* 01-02 (1)*
Northern & Central Europe & European USSR	08-10 (1)	07-08 (1) 08-10 (2) 10-12 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-12 (2) 12-14 (1) 23-01 (1)	17-19 (1) 19-22 (2) 22-01 (1) 19-00 (1)*
Eastern Mediterranean & Middle East	08-11 (1)	07-08 (1) 08-10 (2) 10-12 (1)	06-10 (1) 10-14 (2) 14-16 (1) 22-01 (1)	18-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)*
West & Central Africa	08-09 (1) 09-12 (2) 12-14 (1)	07-08 (1) 08-10 (2) 10-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-19 (2) 19-21 (1)	18-21 (1) 21-23 (2) 23-01 (1)
East Africa	08-10 (1) 10-11 (2) 11-13 (1)	07-11 (1) 11-15 (2) 15-17 (1)	06-12 (1) 12-14 (2) 14-17 (3) 17-18 (2) 18-20 (1)	19-23 (1)
South Africa	08-09 (1) 09-12 (2) 12-13 (1)	07-09 (1) 09-11 (2) 11-14 (3) 14-15 (2) 15-16 (1)	07-13 (1) 13-15 (2) 15-17 (3) 17-19 (2) 19-21 (1) 23-01 (1)	18-19 (1) 19-21 (2) 21-23 (1)
Central & South Asia	08-10 (1) 18-20 (1)	08-10 (1) 19-21 (1)	06-07 (1) 07-09 (2) 09-11 (1) 19-22 (1)	06-08 (1) 19-21 (1)
Southeast Asia	08-10 (1) 18-20 (1)	08-11 (1) 16-17 (1) 17-19 (2) 19-20 (1)	07-08 (1) 08-10 (2) 10-12 (1) 16-18 (1) 18-20 (2) 20-21 (1)	04-07 (1)
Far East	16-19 (1)	07-09 (1) 14-16 (1) 16-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 15-17 (1) 17-18 (2) 18-19 (3) 19-21 (2) 21-23 (1)	02-08 (1) 04-07 (1)*
South Pacific & New Zealand	11-13 (1) 13-14 (2) 14-15 (3) 15-16 (2) 16-18 (1)	10-12 (1) 12-14 (2) 14-17 (3) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (3) 09-12 (2) 12-15 (1) 15-17 (2) 17-22 (3) 22-00 (2) 00-02 (1)	23-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1) 03-07 (1)*
Australasia	09-11 (1) 14-15 (1) 15-17 (2) 17-18 (1)	08-14 (1) 14-15 (2) 15-17 (3) 17-19 (2) 19-21 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-15 (1) 15-17 (2) 17-21 (3) 21-22 (2) 22-00 (1)	02-04 (1) 04-07 (2) 07-09 (1) 03-06 (1)*
North & Central South America	08-09 (1) 09-10 (2) 10-14 (3) 14-15 (2) 15-16 (1)	06-07 (1) 07-08 (2) 08-12 (3) 12-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-07 (2) 07-11 (3) 11-14 (2) 14-16 (3) 16-18 (4) 18-20 (3) 20-22 (2) 22-00 (1) 00-02 (2) 02-06 (1)	18-20 (1) 20-22 (2) 22-03 (3) 03-05 (2) 05-07 (1) 19-21 (1)* 21-01 (2)* 01-04 (1)*
Brazil, Argentina, Chile & Uruguay	08-11 (1) 11-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	07-08 (1) 08-13 (2) 13-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-08 (2) 08-14 (1) 14-15 (2) 15-16 (3) 16-18 (4) 18-21 (3) 21-02 (2) 02-06 (1)	19-21 (1) 21-02 (2) 02-05 (1) 21-04 (1)*
McMurdo Sound, Antarctica	*Nil*	07-09 (1) 14-16 (1) 16-18 (2) 18-19 (1)	16-18 (1) 18-20 (2) 20-23 (3) 23-01 (2) 01-03 (1) 07-09 (1)	22-05 (1)

Time Zone: PST (24-Hour Time)

WESTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Arica	08-10 (1)	07-08 (1) 08-10 (2) 10-11 (1)	05-06 (1) 06-09 (2) 09-11 (3) 11-13 (2) 13-15 (1) 00-03 (1)	18-20 (1) 20-23 (2) 23-01 (1) 19-23 (1)*

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- Specifically designed for the TR-3, TR-4 and TR-6
- Installs in seconds
- TR quality
- Pre-aligned — no adjustments
- In-out switch
- Small size — by use of crystal filter and solid state components

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10M
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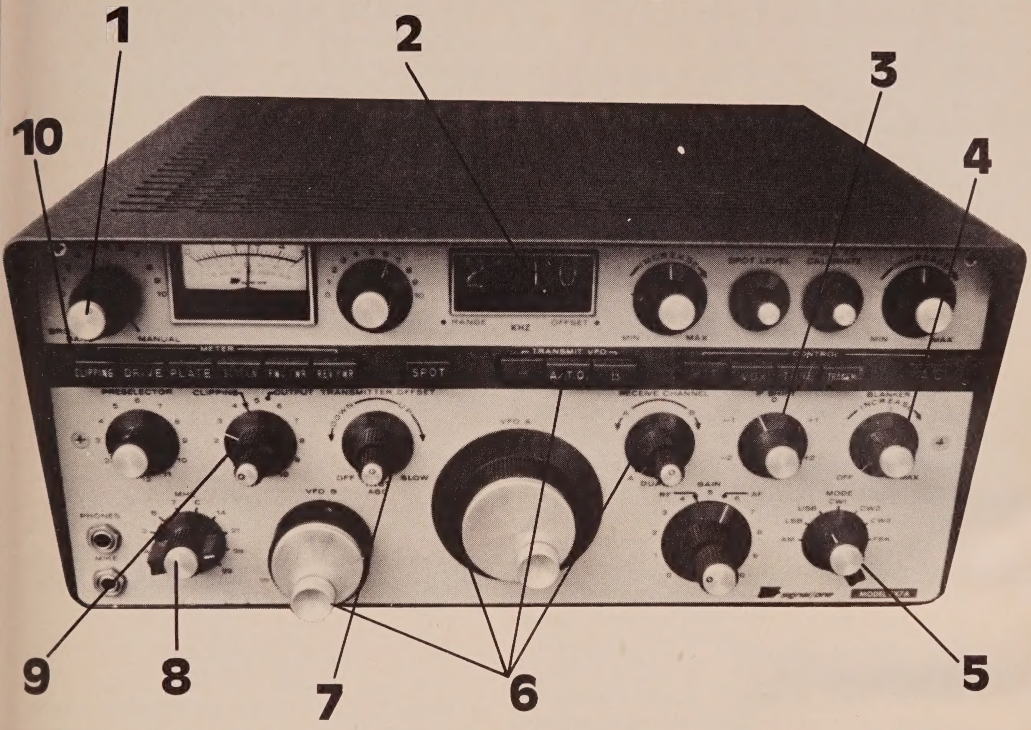
Central & Northern Europe & European USSR	07-09 (1)	07-10 (1)	06-07 (1) 07-10 (2) 10-13 (1) 00-04 (1)	17-00 (1) 19-23 (1)*
Eastern Mediterranean & Middle East	07-09 (1)	07-10 (1)	06-07 (1) 07-10 (2) 10-13 (1) 00-03 (1)	18-21 (1)
West & Central Africa	08-10 (1) 10-11 (2) 11-12 (3) 12-13 (2) 13-14 (1)	06-08 (1) 08-10 (2) 10-12 (3) 12-14 (4) 14-15 (2) 15-16 (1)	05-10 (1) 10-13 (2) 13-15 (3) 15-17 (4) 17-18 (2) 18-20 (1) 00-03 (1)	18-22 (1)
East Africa	09-12 (1)	08-12 (1) 12-14 (2) 14-15 (1)	08-13 (1) 13-17 (2) 17-19 (1)	18-20 (1)
South Africa	08-09 (1) 09-10 (2) 10-12 (1)	07-09 (1) 09-11 (2) 11-13 (3) 13-15 (2) 15-16 (1)	07-11 (1) 11-14 (2) 14-17 (3) 17-19 (2) 19-20 (1) 00-02 (1)	18-20 (1)
Central & South Asia	17-19 (1)	08-10 (1) 16-17 (1) 17-19 (2) 19-20 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-20 (2) 20-21 (1)	05-07 (1) 18-20 (1)
Southeast Asia	14-15 (1) 15-17 (2) 17-18 (1)	09-11 (1) 15-16 (1) 16-17 (2) 17-18 (3) 18-19 (2) 19-20 (1)	07-09 (1) 09-11 (2) 11-13 (1) 13-15 (2) 15-18 (1) 18-20 (2) 20-21 (1)	03-08 (1)
Far East	14-15 (1) 15-17 (2) 17-18 (1)	13-15 (1) 15-16 (2) 16-17 (3) 17-19 (2) 19-20 (1)	08-10 (1) 13-14 (1) 14-15 (2) 15-18 (3) 18-20 (2) 20-21 (1)	00-01 (1) 01-03 (2) 03-06 (3) 06-08 (2) 08-10 (1) 02-08 (1)*
South Pacific & New Zealand	11-13 (1) 13-14 (2) 14-15 (3) 15-16 (2) 16-17 (1)	08-10 (1) 10-13 (2) 13-15 (3) 15-17 (4) 17-18 (3) 18-20 (2) 20-21 (1)	06-07 (1) 07-10 (2) 10-15 (1) 15-16 (2) 16-18 (3) 18-21 (4) 21-22 (3) 22-00 (2) 00-02 (1)	22-00 (1) 00-03 (2) 03-06 (3) 06-07 (2) 07-08 (1) 00-03 (1)* 03-06 (2)* 06-07 (1)*
Australasia	13-15 (1) 15-17 (2) 17-18 (1)	08-12 (1) 12-16 (2) 16-18 (3) 18-19 (2) 19-20 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-14 (1) 16-18 (1) 18-22 (2) 22-00 (1) 02-05 (1)	01-03 (1) 03-06 (2) 06-08 (1) 01-03 (1)* 03-06 (2)* 06-07 (1)*
Northern & Central South America	08-09 (1) 09-10 (2) 10-14 (3) 14-15 (2) 15-16 (1)	06-07 (1) 07-08 (2) 08-12 (3) 12-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	06-07 (2) 07-09 (3) 09-13 (2) 13-15 (3) 15-18 (4) 18-20 (3) 20-22 (2) 22-06 (1)	18-20 (1) 20-22 (2) 22-03 (3) 03-04 (2) 04-05 (1) 19-21 (1)* 21-01 (2)* 01-04 (1)*
Brazil, Argentina, Chile & Uruguay	08-11 (1) 11-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	07-10 (1) 10-12 (2) 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	12-14 (1) 14-15 (2) 15-16 (3) 16-18 (4) 18-21 (3) 21-01 (2) 01-06 (1) 06-08 (2) 08-12 (1)	20-22 (1) 22-01 (2) 01-04 (1) 22-02 (1)*
McMurdo Sound, Antarctica	*Nil*	07-09 (1) 14-16 (1) 16-18 (2) 18-19 (1)	16-18 (1) 18-19 (2) 19-22 (3) 22-01 (2) 01-03 (1) 07-09 (1)	23-05 (1)

Somebody once said there's no price for perfection.



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Q AND A

BY WILFRED M. SCHERER,* W2AEF

Reception of Space Signals

QUESTION: I have become interested in space communications. It is planned to use a 51J-4, SP-600JX, HQ-180X, plus converters. How would you suggest arranging these in a setup so I can use any receiver or two for sort of a diversity-type reception?

ANSWER: Signals from space (satellites) are either vertically, horizontally or circularly polarized, depending both on the attitude of the spacecraft antenna systems and the anomalies over the transmission paths. For diversity-type reception you can use separate receiving systems, one with vertically-polarized antenna, the other with horizontally-polarized antenna. On the other hand, a simpler and probably more satisfactory method is to use a multi-polarized antenna with one receiving system. This will handle vertical and horizontal signals as they change over the transmission paths. A suitable antenna for the job is the "Twist" made by Cushcraft. See the December 1970 *CQ* for a lashup using these antennas. Any good converter will do the job in conjunction with the above mentioned receivers.

Cheap 1:1 Balun

QUESTION: I have been looking for an article showing how to construct a solenoid-wound 1:1 balun. There was an article several years ago on one described by Bill Orr, W6SAI, but I cannot locate it. Where may the data be found?

ANSWER: Bill Orr's article described an inexpensive solenoid-type 1:1 balun under the title of "Broad-Band Balun for a Buck." This was published in *CQ,* February 1966, page 42. For data on a toroid-wound balun see the Q & A Column in *CQ,* February 1969.

6KD6's With HT-37

QUESTION: I have been considering changing the 6146's in my Hallicrafters HT-37 to 6KD6's in an attempt to increase power. I realize that this would require a power-supply change and possibly drive. What would be required to make the change?

ANSWER: Changing over to a pair of 6KD6's in the HT-37 would necessitate a probable change in screen voltage, bias (depending on plate voltage), parasitic chokes, neutralization, realignment at drive output—plus a power supply that will handle the extra plate current. The tank components, as far as voltage breakdown goes, probably would be okay; however, the *L/C* ratios might have to be changed for proper matching to the lower plate impedance of the 6KD6's and thus maintain the least tube heating while obtaining good output with the lowest distortion products. At any rate, the latter are liable to be poorer than with the 6146's. You'll also incur the necessity of a real quick tune-up to keep the tubes from burnup. Personally, I'd forget the whole idea and lean toward a small linear. An 800-watt p.e.p.-input job with 4-6KD6's is described in the 1971 ARRL *Handbook.*

More On 20-Meter Operation With HW-16

In the Q & A Column for October suggestions were given as to how the HW-16 transceiver might be set up for 20-meter operation. Since then, Bud Haake, W0MSV, sent in a note on how he found a simple solution. His letter is quoted as follows:

"Thought I'd let you know how the 20-meter modification to my Heath HW-16 transceiver turned out. I stumbled across a pretty simple solution. The following steps did the trick:

1. Changed oscillator crystal 26.545 kc to 19.545 kc.
2. Removed mixer slug of L_1 and added 6 1/2 turns of hookup wire to the existing coil.
3. Moved tap on p.a. tank coil to exactly half-way between the 15- and 40-meter taps.
4. Added a 150 mmf resin (mica) capacitor across driver coil L_9.

"I found that the receiver coil L_4 required no padding and no additional capacitance was needed at the p.a. tank. It only loads up to about 70 watts with the loading capacitors

[*Continued on page 85*]

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*Technical Director, *CQ.*

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Nov.	**27-28**	**CQ WW DX C.W. Contest**
Dec.	4-5	Indiana QSO Party
Dec.	4-5	Telephone Pioneers Party
Dec.	11-12	Spanish C.W. Contest
Dec.	11-12	ARRL 160 Contest
Dec.	18-20	National Awards Hunters Club
Jan.	8-9	ARRL VHF Sweepstakes
Jan.	**29-30**	**CQ WW 160 C.W. Contest**
Jan.	29-30	French C.W. Contest
Feb.	5-6	ARRL DX Phone Contest
Feb.	19-20	ARRL DX C.W. Contest
Feb.	26-27	French Phone Contest
Feb.	26-27	YL-OM Phone Contest
Mar.	4-5	ARRL DX Phone Contest
Mar.	11-12	YL-OM C.W. Contest
Mar.	18-19	ARRL DX C.W. Contest

Indiana QSO Party

Two Periods: (GMT)

1900 Sat. Dec. 4 to 0600 Sun. Dec. 5

1600 to 2400 Sunday, December 5

The same station may be worked on each band and mode for QSO points.

Exchange: QSO nr., RS(T) & QTH; county for Ind., state, province, country for others.

Scoring: One point per QSO. Ind. multiply by number of states, VE provinces and countries worked. Out-of-state stations use Ind. counties for their multiplier. (max. of 92) Indiana may work each other for QSO points.

Frequencies: C.W. — 3535, 7035, 14035, 21035, 28035. Phone—3910, 7265, 14295, 21395, 28600, 50400.

Awards: Certificates to the top stations in each state, province, country and Indiana county. Special award to the top in and out of state scorer.

Mailing deadline Dec. 31st to: Thomas J. Thamann, WA9MXG, 5013 Nowland Ave., Indianapolis, Ind. 46201. Include an s.a.s.e.

Telephone Pioneers QSO Party

Starts: 1900 GMT, Saturday, December 4

Ends: 0500 GMT Monday, December 6

This is the seventh annual party in which telephone pioneer ham radio operators will be able to contact other members in the United States and Canada. The same station may be worked on each band and modes.

Exchange: Signal report, contact number, chapter name and number.

Scoring: One point for each contact, and one point for each chapter worked.

Frequencies: Phone — 3965, 7260, 14295, 21365, 28675 50.1 to 50.25 and 144.275 to 145.5. C.W.—3565, 7065, 14065, 21065.

Be sure to indicate your chapter name in your log and mail no later than January 6th to: Frank J. Wojcik, W2SNJ, Stanley S. Holmes Chapter #55, Telephone Pioneers of America, 100 Central Avenue, Kearney, N.J. 07032

Spanish C.W. Contest

Starts: 2000 GMT Saturday, December 11

Ends: 2000 GMT Sunday, December 12

This is a new contest organized by the Union de Radioaficionados Espanoles. Stations in all EA districts and zones will be working the rest of the world on all bands, c.w. only.

Exchange: Six figures, RST plus a 3 figure contact number starting with 001.

Points: Contacts between EA stations and Philippines or Hispanoamerica states are worth *3 points*. (DU, CE, CM, CP, CX, HC, HI, HK, HP, HR, KP4, LU, OA, PY, TG, TI, XE, YN,

Some of the operators at Multi stations UA9KAX, UK9AAN and UK9ABA in past contests. L. to R.—UW9BY, UA9AQB/UA0, UA9AN, UA9BB, UA9BE and UW9AF. Sam, UA9AN has also been very successful as a singles winner.

---

*14 Sherwood Road, Stamford, Conn. 06905

This is what you call contesting in comfort. The RTTY DX-pedition to Leichenstein, HB0D during the April '71 WAE RTTY Contest. L. to R.—HB9P, HB9-AIK (ex-VK2ANI) and HB9WP.

YS, YV and ZP or equivalent prefixes.)

EA and all other non-European stations, *2 points.*

EA and European stations, *1 point.*

The same station may be worked on each band for QSO and multiplier credit.

	Maximum D.C. Plate Input Power in Watts															
Area	1800 to 1825 kc		1825 to 1850 kc		1850 to 1875 kc		1875 to 1900 kc		1900 to 1925 kc		1925 to 1950 kc		1950 to 1975 kc		1975 to 2000 kc	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Alabama	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Alaska	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
Arizona	1000	200	500	100	500	100	0	0	0	0	0	0	0	0	0	0
Arkansas	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
California	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
Colorado	1000	200	500	100	200	50	0	0	0	0	0	0	0	0	200	50
Connecticut	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Delaware	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
District of Columbia	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
Florida	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Georgia	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Hawaii	0	0	0	0	0	0	0	0	200	50	100	25	100	25	500	100
Idaho	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Illinois	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Indiana	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Iowa	1000	200	500	100	200	50	0	0	0	0	100	25	100	25	500	100
Kansas	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
Kentucky	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Louisiana	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Maine	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Maryland	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
Massachusetts	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Michigan	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	100	25
Minnesota	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Mississippi	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Missouri	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
Montana	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Nebraska	1000	200	500	100	200	50	0	0	0	0	100	25	100	25	500	100
Nevada	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
New Hampshire	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
New Jersey	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
New Mexico	1000	200	500	100	100	25	0	0	0	0	100	25	500	100	1000	200
New York	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
North Carolina	500	400	100	25	0	0	0	0	0	0	0	0	0	0	100	25
North Dakota	1000	200	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Ohio	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	100	25
Oklahoma	1000	200	500	100	100	25	0	0	0	0	100	25	100	25	500	100
Oregon	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
Pennsylvania	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Rhode Island	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
South Carolina	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
South Dakota	1000	500	500	100	500	100	100	25	100	25	100	25	100	25	500	100
Tennessee	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	200	50
Texas	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Utah	1000	200	500	100	500	100	100	25	100	25	0	0	0	0	100	25
Vermont	500	100	100	25	0	0	0	0	0	0	0	0	0	0	0	0
Virginia	500	100	100	25	0	0	0	0	0	0	0	0	0	0	100	25
Washington	1000	200	500	100	500	100	100	25	0	0	0	0	0	0	0	0
West Virginia	1000	200	500	100	100	25	0	0	0	0	0	0	0	0	100	25
Wisconsin	1000	200	500	100	200	50	0	0	0	0	0	0	0	0	200	50
Wyoming	1000	200	500	100	500	100	100	0	100	25	0	0	0	0	200	50
Puerto Rico	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Virgin Islands	500	100	100	25	0	0	0	0	0	0	0	0	0	0	200	50
Swan Island	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Serrana Bank	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Roncador Key	500	100	100	25	0	0	0	0	0	0	0	0	100	25	500	100
Navassa Island	500	100	100	25			0	0	0	0	0	0	0	0	200	50
Baker, Canton					0	0										
Enderbury, Howland	100	25	0	0			100	25	100	25	0	0	0	0	100	25
Guam, Johnston,					0	0										
Midway	0	0	0	0	0	0	0	0	100	25	0	0	0	0	100	25
American Samoa	200	50	0	0	0	0	200	50	200	50	0	0	0	0	200	50
Wake	100	25	0	0	0	0	100	25	0	0	0	0	0	0	0	0
Palmyra, Jarvis	0	0	0	0	0	0	0	0	200	50	0	0	0	0	200	50

160 Meter Regulations

Multiplier: For EA stations, each DXCC country worked on each band. All others, each EA call district worked on each band.

Final Score: Total QSO points from all bands multiplied by the sum of the multiplier from all bands.

Awards: A silver medal goes to the first place winner, a diploma to the second place winner. (For each country ?)

Keep your log with 20 QSOs to the page, and include a summary sheet showing the scoring and other pertinent information, with your name and address in BLOCK LETTERS.

Your entry must be postmarked no later than one month from the end of the contest. To: U.R.E. Concurso International, P.O. Box 220, Madrid, Spain.

ARRL 160 C.W. Contest

Starts: 2200 GMT Friday, December 10

Ends: 1600 GMT Sunday, December 12

The ARRL Contest Advisory Committee has seen fit to include DX contacts as a multiplier in this year's contest. Good thinking.

Contacts will be between stations in ARRL sections, and with DX. (DX to DX no go)

Exchange: RST and your ARRL section. (non-ARRL send report only)

Scoring: Contacts between stations in an ARRL section, 2 points. (see list in QST) QSOs with other areas, 5 points.

The multiplier is determined by the number of ARRL sections worked (max. of 74) plus DX countries. (non-W/VE)

Awards: Certificates to each ARRL section and DX country winners.

You are of course required to keep a valid log of all contacts made, it is not necessary however to submit it for contest purposes. To report, use one of the ARRL summary sheets and an alphabetical list of stations worked. (Operating Aid 6) A s.a.s.e. to ARRL Hq. will get you the necessary forms.

The usual grounds for disqualification prevail, and you may be requested to submit a copy of your log for verification.

All entries must be received no later than Jan. 10, 1972 at ARRL Hq. 225 Main Street, Newington, Conn. 06111

N.A.H.C. Contest

Starts: 1500 GMT Saturday, December 18

Ends: 0300 GMT Monday, December 20

The New York State Chapter of the National Awards Hunters Club is the sponsor of this one.

Exchange: Name, QTH and if member of NAHC.

Scoring: 1 point per QSO for non-members, and 2 points for members.

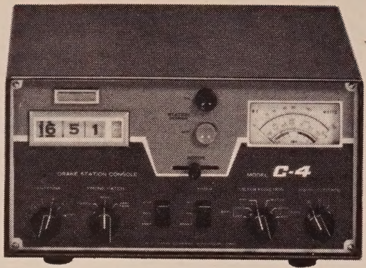
Awards: Plaques will be awarded as follows:

T-4XB Transmitter

R-4B Receiver

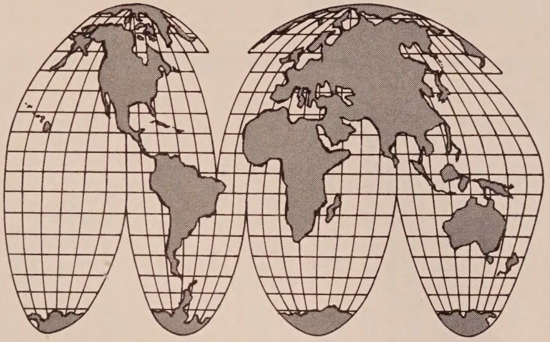
R-4B
RECEIVER

C-4 Station Console


DRAKE STATION CONSOLE
MODEL C-4
16 5 1

MS-4 Speaker

MS-4 SPEAKER



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1971 BARTG RTTY Contest Results

North America

W3KV	85,410	WB6SCH	22,534
VE7UBC	74,460	WA0ATY	22,032
WA2YVK	69,840	W7TZL	21,182
HP1XHG	52,000	K1YGF	14,700
WA6WGL	37,700	WA6TLA	14,580
KZ5LF	34,980	WB6QFE	6,940
K1LPS	29,304	W3CIX	4,872
W5EUN	27,132	WB6RXM	3,220
W6AEE	24,440	W8TCO	1,736
WA6KDI	22,974		

W3KV placed 7th world high in a total of 58 entries.

Highest total of points on h.f., highest number of members worked on h.f., highest total on v.h.f./u.h.f., and highest number of members worked on v.h.f./u.h.f.

Make up your log so that there are 25 entries to the page.

Mailing deadline is February 1st to: Contest Chairman, Larry S. Friedman, WB2KHO, 50-07 203rd St., Bayside, N.Y. 11364

Editor's Notes

Time is running out if you haven't already sent in your Phone Contest log. It's the 1st of December for the phone. You have until January 15th for your c.w. entries.

We solicit your log, no matter how small. Remember, we publish all calls regardless of how small your score may be. They sometimes prove very useful in the checking of other logs.

Rules for our 160 Contest are the same as last year and will be given in details in next month's CALENDAR.

Another year has gone by the boards and once again its time to extend greetings of the Holidays to the many faithful readers of this Column. May your Christmas be a Merry one and may you and yours receive many Blessing in the coming year.

73, Frank, W1WY

1971 WAE RTTY Contest Results

North America

Alaska		WA2YVK	11,988
KL7GRF	6,420	W2VAQ	4,732
Canada		K2RYI	408
VE7UBC	29,858	WA3KEG	12,874
USA		W3CIX	6,118
W1GKJ	6,214	W3KV	759
W1KQY	5,474	WA6WGL	19,224
K1YGF	90	W6AEE	896
W2LFL	15,576	W7CBY	640

VE7UBC was world high scorer and WA6WGL placed 2nd high among the non-Europeans.

THE awards PROGRAM

BY ED HOPPER,* W2GT

Special Honor Roll
All Counties
#62 Richard H. Lennon, W2BLM 8-20-71.
#63 Willis Sutherland, WA9FZR 8-24-71.

USA-CA HONOR ROLL

3000		2000		1000	
W2BLM	81	K4ELK	138	K4ELK	246
WA9FZR	82	W2BLM	139	WA9FZR	247
2500		WA9FZR	140	**500**	
W2BLM	116	**1500**		K4ELK	863
WA9FZR	117	W2BLM	172	WA9FZR	864
		K4ELK	173	WA2FLA	865
		WA9FZR	174	K4HQI	866

THE "Story of The Month" for December, is:

Leo C. Haijsman, W4KA
(All Counties #43, 10-13-70)

It all started when Leo became interested in the transmission of information by Wireless, while still a boy on his Father's farm in the state of Iowa. From the parts purchased from "Murdock" and several local electrical stores, he put together a crystal detector and with the coveted "Brandies" headset, heard his first radio signal from the ether in 1922. It was only a short time later, that through a careful savings plan, he was able to purchase a UV-200 audion vacuum tube and thus was able to hear distant broadcast stations and even more important, c.w. signals from other amateurs and the military.

This experience soon led to the desire to communicate and in 1923 his first license (Federal Radio Commission) was obtained under the call of 9CIY. This license authorized spark equipment for operation in the 176 to 200 meter band. A home built receiver of the regenerative type was constructed, using a vario-coupler, and with a helix and a fixed gap, the station was in operation. Enthusiasm blossomed and Leo progressed with the art, through the years to the use of modern s.s.b. equipment.

After graduation from Iowa State College, Ames, Iowa in 1930, employment was found with the Cities Service Oil Company, as a young engineer, in their oil refining operations. Later he aspired to Government work and completed 30 years serving with the U.S. Bureau of Mines, U.S. Maritime Commission and later in the Washington Office of the Federal Communications Commission. He is now retired and living at 1044 S. E. 43rd St., Cape Coral, Florida 33904.

With the advent of *CQ*'s County Hunting challenge, the spark of competition was rekindled in 1965 and an earnest effort was made to meet this challenge. However, it was not until October of 1970 that All 3079 counties was achieved and number 43 (All Fone) was assigned to W4KA.

In addition to amateur radio, his other hobbies lead him down the paths of: coin collecting, lapidary (cut and polished rocks), electroplating, genealogy, and traveling.

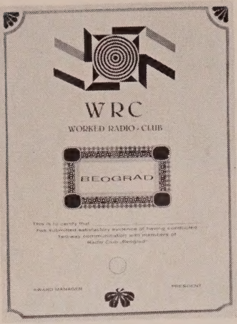
Since retiring to Florida, Leo, has managed to help many a County Hunter acquire more counties, as it seems as though the "Camper" just can't pass up those good/rare county lines.

LEO HAIJSMAN OPERATOR

W4KA at the home station.

---

*P.O. Box 73, Rochelle Park, N.J. 07662.



WRC

WORKED RADIO-CLUB

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PRESIDENT

WRC—Belgrade Award

To quote Leo, "The County Hunters Convention during the week of July 4th (KC-71) confirmed the fact that the County Hunters are the most co-operative and nicest folks of the entire amateur fraternity. If you want to prove this, attend their next convention (Peoria, Ill., July 4th, '72) or have an eye ball QSO with any one of the group".

Leo is married, has two children and is a proud grandfather. He holds membership in DXCC, WAS, WAC, ISSB, QCWA, A-1 Operator, All Counties, and MARAC.

Yes! You'll be hearing more from Leo, both from his home station and from his camper, out in the far away county lines.

Awards Issued

As shown in the Special Honor Roll, Dick Lennon, W2BLM acquired All Counties #62, All A3A, as well as All A3A 3000, 2500, 2000 and USA-CA-1500 All 20M A3A.

"Paul" Sutherland, WA9FZR held out until he hit them *all* and then applied for All Counties and 3000 Mixed; 2500 and 2000 All A3A; 1500 and 1000 All 20M, All A3A; and USA-CA-500-All 20; All 4C All 75 and All A3A.

Walt Morris, K4ELK was issued USA-CA-2000 Mixed and 1500, 1000, and 500 All 14 MC, All Mobiles, All S.S.B.

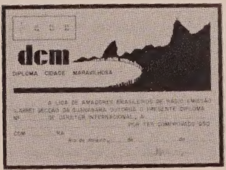
Don Goodman, WA2FLA qualified for USA-CA-500 All S.S.B.

Lloyd Westbrook, Jr., K4HQI also qualified for USA-CA-500.

Awards

Diploma of The French Americas: This DAF Award as described in March '71 *CQ* and issued by Alex Desmeules, VE2AFC, P.O. Box 382, Quebec 4, Que., Canada costs $1.00 or 10 IRCs.

Diploma Cidade Maravilhosa: This DCM (Wonderful City Award) is sponsored by LABRE, Seccional Directory of the State of Guanabara. It is available to all amateurs of the world for confirmed contacts with stations in at least 10 different Administrative Regions of the city of Rio de Janeiro, State of Guanabara, the well known Brazilian "Wonderful City", beginning January 1969. For the basic (class D) DCM Award, 10 Administrative Regions (RA) are needed. There are the following endorsements: Class C-15 Administrative Regions, Bronze Seal. Class B-20 Administrative Regions, Silver Seal. Class A-23 Administrative Regions, Gold Seal. Any authorized amateur band and any mode of transmission are allowed, but there are no special endorsements for band or mode. Send log data, verified by local Radio Club or GCR, listing station call, time and date of contacts to: LABRE, Diretoria Seccional GB, Caixa Postal 58, ZC-00, Rio de Janeiro, GB, Brazil. There is no fee for the DCM proper, but 5 IRCs are welcome to cover mailing costs. Note—usually QSLs of Rio de Janeiro amateurs indicate the Administrative Region where the station is located: I-RA, II-RA, III-RA, etc....



dcm

DIPLOMA CIDADE MARAVILHOSA

DCM Award

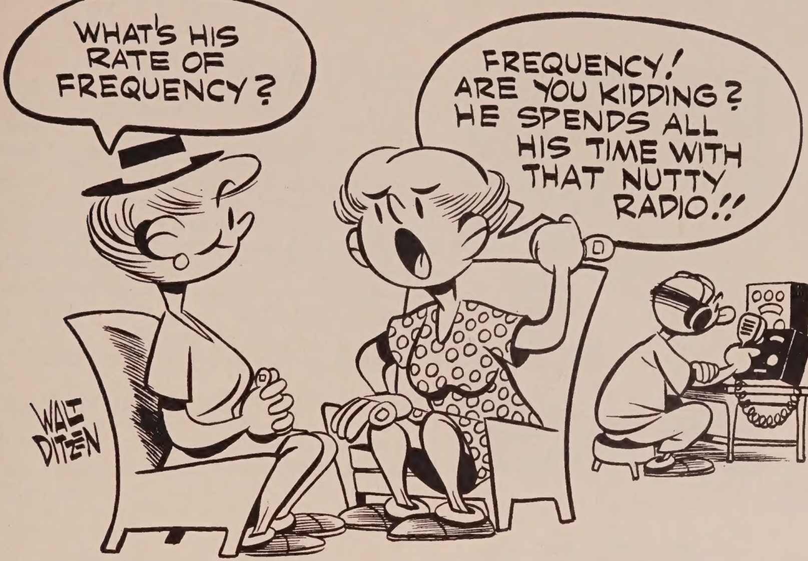
WRC Beograd: Worked Radio Club, Beograd sponsored by The Radio Club, Beograd is issued for two way contacts (c.w., a.m., s.s.b. or Mixed, all bands) with members of the club whose QSLs have been received by the members worked. QSOs must be January 1, 1951 and later, same rules apply to swls. Yugoslav stations need 8 contacts, other Europeans need 5 contacts and all others need 3 contacts. Members are YU1AAQ, AEG, AFQ, AK, APO, ARQ, AU, BKL, CV, CW, EO, FM, KL, LU, MV, NBR, NBQ, NBT, NBU, NCD, NED, NEO, NHD, NHV, NID, NOC, NOP, NOR, NPW, NPZ, NRK, NSF, NSH, NSN, NSW, NUK, NUM, NUN, NRW, NYE, OAW, PKW, QAA, SJ, SW, YR, NVU, NZN, NYO, OAU. Extracts of log and 10 IRCs (10 Din) should be sent to: AWARD Manager, P.O. Box 235, Belgrade, Yugoslavia. This data was kindly sent by Joso, YU1NSN who is also YU-Check point for CQ DX Awards.

Notes

As this is being written, I have just received an air letter from Al Shawsmith, VK4SS wondering if I had received his *USA-CA Record Book*/ Application sent 1 May '71 via Registered Air Mail, his letter is dated 1 Sept. '71 and his *Record Book* has not arrived. My routine is that when received, *Record Books* are checked within a day or 2 and a letter is sent at once with all data and the Award is sent via 3rd class mail within a few days. In the case of applicants outside the U.S.A., I always notify them via Air Letter, as I know that sea mail can take months. Sorry, but Al's *Record Book* is apparently lost.

In case my readers might get the idea that all County Hunting is done on s.s.b., let me advise you that *much* County Hunting is done on

SAROC • JANUARY 6-9, 1972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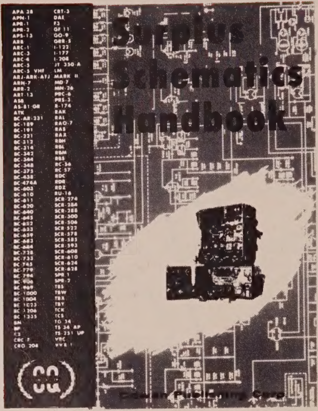

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ARC1
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c.w. on 14070 and 7055 and there is a *C.W. County Hunters Newsletter* published by James E. Hoffman, K1ZFQ, 42 Gresham St., Milford, Conn. 06460 and the cost in the USA is $1.75 via surface mail and $2.10 via air mail.

Yes, there are now *two* QSL Bureaus (or call them what you will) established to help County Hunters forward their QSLs and get replys.

The International County Hunters Mobile QSL Agency, P.O. Box 146, Lakeside, California 92040 (Run by Dave Manescu, W6CCM). Life membership, $1.00 Mobile cards handled for just 2c each plus s.a.s.e. to cover return of certified cards to you. Bundle cards, arrange alphabetically by call areas, and send. To try to answer some questions that might arise, cards will be forwarded to the mobileers on the 1st and 15th of each month with s.a.s.e. for their return to the agency who will then send to the member station at no additional cost. Yes, you can enclose one of your own QSLs with the CH QSL in case the mobileer needs your county, but don't forget that counts as an additional card. I feel that Dave will even forward QSLs for fixed stations that you worked on the ICHN, and I believe he will even accept your regular cards for MARAC Awards. A couple of minor changes, cards will be forwarded to a mobileer as soon as the Agency has 8 or 10 cards for him. He would also like s.a.s.e. in 8¢ types, that is, if you send in 50 cards and they cost you 40¢ to send, he would desire 5 envelopes with 8¢ on each envelope, instead of 40¢ on one envelope as all your cards will not be answered by different mobileers at the same time. I believe Dave will do everything possible to make it work correctly and perhaps you might have ideas as time goes along that you could send to him.

The QSL Clearing-House for County-Hunters has been formed by: R. C. Schmarder, WA2AEA, 4 Pinewood Circle, Corning, N.Y. 14830. Bob figured that if each of the 3077 counties were QSLed separately, the postage alone would total $430.78, thus the idea for his Clearing House. The County Hunter sends $1.00, four s.a.s.e. and as many mobile reply cards that will make up the one-ounce limit (or two ounces if he has enough cards). The County Hunter then sends lots of mobile reply cards (in one or two ounce envelopes) until he receives back the four stamped envelopes, each containing one ounce of cards. The Clearing House will forward cards to the mobiler, along with a return envelope addressed to the Clearing House—again, using the full limit of weight. Using the weight of cards and envelopes in his stock, the following are samples of one-ounce weights: #1= 1 #10 envelope, 4 #6¾ envelopes, 1 dollar bill, and 6 Moble reply cards. Example #2= 2 #6¾ envelopes, 1 instruction sheet, and 10 reply cards.

[*Continued on page 84*]

SURPLUS sidelights

BY GORDON ELIOT WHITE*

DURING the Korean War the Radio Corporation of America produced a series of general-purpose electronic units for the U.S. Navy, under nomenclature FRR for fixed-station, MRR for mobile, SRR for shipboard, and URA for common-use demodulators. Consisting of low, medium and high-frequency communications receivers and audio and intermediate-frequency type radio teleprinter demodulators, these sets employed then state-of-the-art techniques, including miniaturization, subminiature tubes, and modular construction. Their design bridged the gap between conventional tube sets and early solid-state equipment, and served the Navy for almost two decades.

The AN/FRR-18, -19, -21, -22 and -23, AN/MRR-1, -2 and -3 and AN/SRR-11, -12 and -13 receivers came along at the same time as the Collins R-390 and 390-A designs used by the Army and the Air Force. To my way of thinking the RCA sets are not up to the Collins equipment in most specifications, although both aimed at similar military needs. The Navy equipment was possibly a bit too reliant on the subminiature tube, and the design does not match the Collins bandspread, stability, or digital readout accuracy.

But if found in good condition, the RCA units can offer good value at reasonable prices in surplus.

Fig. 1 is a general view of the FRR, MRR or SRR receiver, circa 1954.

The key to getting a good buy in one of these units is to check the condition. I have found that 95 percent of the R-390 receivers in surplus are operable. Unfortunately, the obverse seems to be true of the MRR/SRR/FRR units. Most of those that get out to private dealers are in need of repairs before they can be used. If properly reworked, they can offer good value, but if bought in an as-is condition, can prove difficult to repair because of the shortage of replacement parts. A number of the sub-systems are hard to work on and tricky to adjust. There is an extensive mechanical control system, and a special optical bandspread device that is not anyone's cup of tea.

The sets used sub-miniature tubes throughout that are more expensive in surplus than the more common 7 and 9-pin miniature bottles, or the later solid state devices.

Many of the SRR/FRR sets I have seen have been canabalized for parts, notably for the tube modules with their soldered-in subminiatures.

In a later up-date, the SRR/FRR/MRR types had some of their subminiature diodes replaced by solid-state devices, notably five 5647 tubes for which 1N458 diodes can be used in positions V1005, V1103, V1106, V1107 and V1101. These are, respectfully, the detector, squelch, limiters, and noise limiter functions. Some saving in filament current is made, but the chief gain is in reliability and availability of replacements.

Some MRR/FRR/SRR sets were further modified with the addition of three mechanical i.f. filters for 3, 8 and 16 kc bandpass—clearly a move to meet the standard set by the R-390-A of Collins. I have no idea how many sets were so modified, but contract records indicate that the changes were incorporated in AN/FRR units bearing serial numbers 26 and up.

The specs of the FRR, MRR and SRR series are shown in fig. 2.

There was an experimental version of this series which incorporated a CV-57 i.f. demod in the same cabinet as the receiver, but I have only seen one, bearing an XA serial, and apparently it was not produced in quantity.

The second intermediate frequency of the RR-series is 200 kc—explaining why many surplus CV-57's are found tuned to that input rather

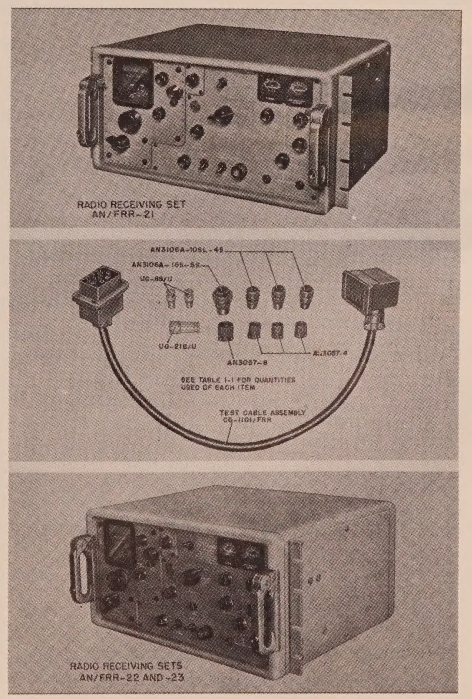

Fig. 1—A general view of the FRR, MRR or SRR receiver.

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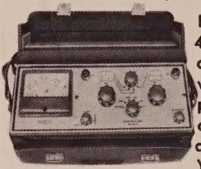

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than the more common amateur receiver i.f. of 455 kc.

In the all-tube sets, the RR receivers use 29 tubes, mostly subminiature except for the 6X4's in the power supply.

The receivers are dual conversion on most bands, with first i.f.s of 60 or 600 kc, depending on bands covered.

Antenna input may be high or low impedance, with the change accomplished by moving a shorting link, 0101 or 0102 inside Z_{101}, the r.f. amplifier module.

If diversity reception is desired, links are provided in the diode detector and a.g.c. circuits for applying a rectified signal voltage and automatic gain control voltage to a second companion receiver to balance the gain of both receivers. Since the URA-6 and URA-8 demod systems were designed for diversity work, a complete setup would consist of a pair of receivers connected to

Frequency	Receiver	Remarks
14-600 kc	AN/FRR-18	crystal local osc., fixed station
	AN/FRR-21	fixed station
	AN/MRR-1	mobile operation
	AN/SRR-11	shipboard station
250 kc—8.0 mc	AN/FRR-22	shore station
	AN/MRR-2	mobile operation
	AN/SRR-12	shipboard station
2—32 mc	AN/FRR-19	crystal local osc., fixed station
	AN/MRR-3	fixed station
	AN/FRR-23	mobile operation
	AN/SRR-13	shipboard station

Fig. 2—Specifications for the FRR, MRR and SRR receivers.

Input	Unit	Remarks
50 kc i.f.	CV-71	
200 kc—500 kc i.f.	CV-57	Identical to the CV-71 except input tuneable over a wide range. (Tuning is critical)
audio type	CV-60	Identical appearance to CV-71, CV-57
	CV-89, -89A	virtually identical to CV-60 except for cabinet design

— all demods are approximately 5½ inches high and fit in 19 inch racks, with tuning display scopes giving flipping-line displays; will handle any shift from 70 c.p.s. to 1,000 c.p.s.

Fig. 3—Demodulator selections available for this series of receivers.

antennas ideally located more than a half-wavelength apart, feeding two CV-57's or CV-89's, with the stronger signal selected by a CM-22 or CM-14 comparator.

A panoramic display output from the mixer cathode follower, V_{352}, at 1,600 kc, available at rear-panel jack J_{4006}, on FRR-22 and -23.

Fig. 3 shows the demodulator selections available in the same series.

The CV-60 was built by Hoffman Electronics as the CV-89, using a virtually identical circuit, but slightly repackaged. As such it served for many years as the standard Navy RATT communications demod until it was superseded by the URA-17 and other solid-state terminal units such as the Frederick 1200 and 1203's.

The receivers are covered in NavShips manual 92211. Fig. 4 is a typical block diagram, showing the FRR-22 unit.

The controls are self-explanatory in general, with only a few special features. Each receiver contains a local crystal calibrator (10 kc on the FRR-21, 50 kc in the FRR-22 and 200 kc on the FRR-23) These provide signals allowing the optical readout to be calibrated. The CAL switch is turned "on" to apply B+ voltage to the calibrating oscillator, and remove B+ from the antenna preamp stage, thus applying a whistle at appropriate points on the tuning scale. Adjustments are made by loosening the thumbscrew holding the CAL ADJUST knob, then turning it to bring the nearest calibration marker under the hairline on the projection screen at the same time that zero beat between the calibration oscillator and the b.f.o. is obtained.

Sensitivity of the receivers is as follows:

14-18 kc	8 microvolts or better
18-100 kc	5 uv or better
100-600 kc	3.5 uv or better
600 kc—8 mc	3 uv or better
8-24 mc	4 uv
24-32 mc	5 uv or better

The most important test fiture for one of these receivers is the cable which can patch the receiver to the connections in the rear of the case while the set is open for maintenance. Known as cable CG-1101/FRR, this piece, or a homemade substitute for it is virtually required in order to work on these receivers, since the power, antenna, and output hookups are all made by sliding the receiver into the jack in the weatherproof case. Alternatively it might be possible to

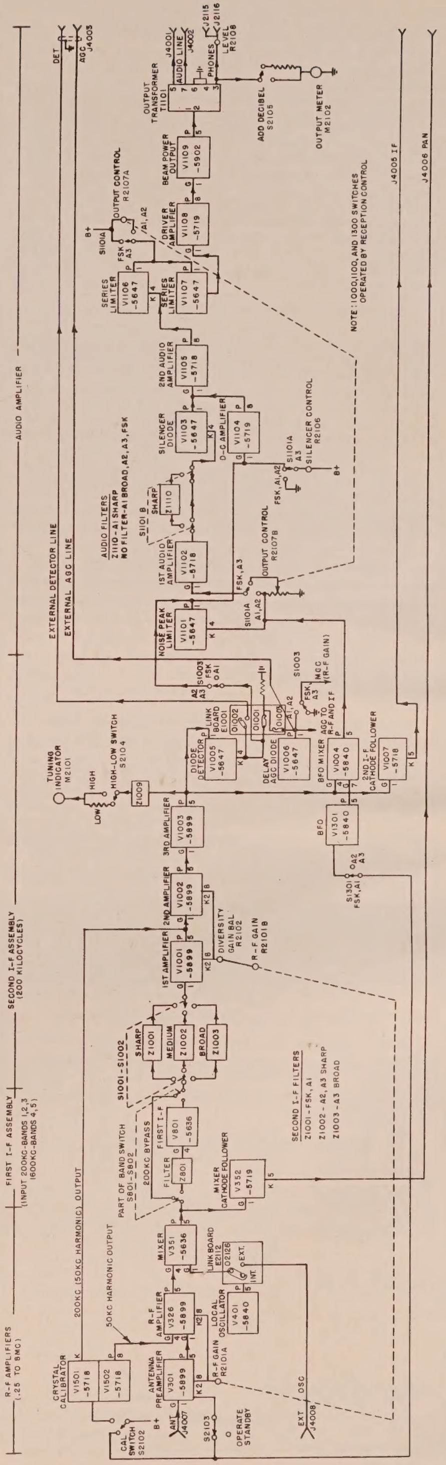
R-F AMPLIFIERS (.25 TO 8MC)
FIRST I-F ASSEMBLY (INPUT 200KC-BANDS 1,2,3 / 600KC-BANDS 4,5)
SECOND I-F ASSEMBLY (200 KILOCYCLES)
AUDIO AMPLIFIER
CRYSTAL CALIBRATOR V1501 -5718
V1502 -5718
CAL SWITCH S2102
ANTENNA PREAMPLIFIER V301 -5899
R-F AMPLIFIER V326 -5899
MIXER V351 -5636
LOCAL OSCILLATOR V401 -5840
LINK BOARD E2112
EXT. INT.
OPERATE STANDBY S2103
R-F GAIN R2101A
EXT J4008 OSC
ANT J4007
B+
200KC (50KC HARMONIC) OUTPUT
50KC HARMONIC OUTPUT
PART OF BAND SWITCH S801-S802
200KC BYPASS
FILTER Z801
FIRST I-F V801 -5636
MIXER CATHODE FOLLOWER V352 -5719
S1001-S1002
SHARP Z1001
MEDIUM Z1002
BROAD Z1003
SECOND I-F FILTERS
Z1001 - FSK, A1
Z1002 - A2, A3 SHARP
Z1003 - A3 BROAD
1ST AMPLIFIER V1001 -5899
2ND AMPLIFIER V1002 -5899
3RD AMPLIFIER V1003 -5899
DIVERSITY GAIN BAL R2102
R-F GAIN R2101B
TUNING INDICATOR M2101
HIGH LOW
HIGH-LOW SWITCH S2104
Z1009
DIODE DETECTOR V1005 -5647
DELAY AGC DIODE V1006 -5647
BFO V1301 -5840
S1301 FSK, A1
A2 A3
BFO MIXER V1004 -5840
2ND I-F CATHODE FOLLOWER V1007 -5718
LINK BOARD E1001
S1003
MGC (R-F GAIN)
AGC TO R-F AND I-F
NOISE PEAK LIMITER V1101 -5647
S1101A A1,A2
FSK, A3
OUTPUT CONTROL R2107B
1ST AUDIO AMPLIFIER V1102 -5718
AUDIO FILTERS Z1110 - A1 SHARP NO FILTER - A1 BROAD, A2, A3, FSK
S1101 B
SHARP Z1110
SILENCER DIODE V1103 -5647
D-C AMPLIFIER V1104 -5719
S1101A A3
SILENCER CONTROL R2106
2ND AUDIO AMPLIFIER V1105 -5718
SERIES LIMITER V1106 -5647
SERIES LIMITER V1107 -5647
DRIVER AMPLIFIER V1108 -5719
OUTPUT CONTROL R2107A
BEAM POWER OUTPUT V1109 -5902
OUTPUT TRANSFORMER T1101
AUDIO LINE J4001 J4002
PHONES J2115 J2116
LEVEL R2108
ADD DECIBEL S2105
OUTPUT METER M2102
EXTERNAL DETECTOR LINE
EXTERNAL AGC LINE
DET
AGC J4003
J4005 IF
J4006 PAN
NOTE: 1000, 1100, AND 1300 SWITCHES OPERATED BY RECEPTION CONTROL

Fig. 4—A typical block diagram for the receiver series. The FRR-22 is shown.

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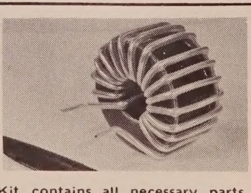

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detach the back plate of the case itself and use it separately with the receiver for maintenance. (Until you have faced it, you have no idea how frustrating it is to have a set which will not operate at all outside its case, and cannot be worked upon with the case closed.)

The tuning display system is an ingenious thing, almost fiendish, and to quote the manual: "The frequency to which the receiver is tuned appears projected on a translucent screen...The projection system consists of a glass disk on which the tuning range of the receiver is calibrated in five scales. A light source is mounted in a housing behind the tuning dial. A portion of one of the optical scales is projected through a system of lenses and onto a mirror which reflects the image of the scale back upon the transluscent screen. The glass disk is rotated by gears as the tuning knob is turned. When the setting of the band selector is changed, the dial light and lens housing is moved up or down by a cam driven by the band selector gears to align the lens system with the corresponding frequency scale on the glass disk." The CAL ADJUST knob provides a means of shifting the frequency scale slightly by horizontal movement of the lens system. ■

USA-CA

[*from page 80*]

Example #3= 1 #6¾ envelope and 15 reply cards. Thus, the average cost is less than 2c per card, you can send your personal QSL in case the mobiler needs your county at 2c per card (stamps acceptable). The Clearing House (Nor Dave, W6CCM) can not guarantee that every mobiler will answer, however experience has shown that mobilers are the best QSLing hams that ever graced the air-waves. The Clearing House will check the cards returned by the mobiler, but only for signature and can not be held responsible for correctness of data shown on the cards. (I feel sure that once they are publicized, there will be plenty of business for both, Ed.)

Many thanks to Gun, JA1BMI; Mikio, JA7DBG (exJA8ZX) and Seiichi, JA2ENU for their kind (badly needed) help in modifying a piece of Japanese equipment. In addition to it being a most difficult job, all instructions were in Japanese, one of the many languages that I have not mastered, Hi!

Wish I had the space to tell you about the many fine books on all phases of electronics, that I have had the pleasure of reviewing, but as I do not—write for their latest list of books to Tab Books, Blue Ridge Summit, Penna 17214.

Hope you have written your letters to "Santa" for all that equipment you desire for Christmas. Have fun with your new gear and antenna but don't forget to write to me and tell me: How was your month? 73 and Merry Christmas, Ed., W2GT.

Q & A [*from page 72*]

unchanged. I thought about swapping positions of C_{31} and C_{32} which would give the same value on 80 and 40, which might increase the loading on 20 for more input. However, I'm satisfied with the 70 watts for the time being. Hope this dope will help someone else. By the way, the sensitivity appears better than it did on 15 meters."

Thanks, Bud. Readers should note that this modification is made at the sacrifice of 15-meter operation.

Decade Counter Notes

The following correspondence may be of interest to readers who like to delve into the principles of operation and the construction of decade counters:

"I have on hand a generous oversupply of an application note dealing with an economy decade counter and display modules (using "Nixie" type display). Because of the IC price war, it seems unlikely that anyone would actually find it economical to build from this information, but it may have some general educational value. If any of your readers would like a copy, I should be happy to send one, as long as the supply lasts, upon receipt of a large SASE."

T. R. Jackson, W1DMU
P. O. Box #1
Corinth, Vermont 05039

Greetings

That time has fast come upon us to say, "Christmas Greetings to all with good health and prosperity (with good DX thrown in) for the New Year. Bill, W2AEF

Letters [*from page 7*]

For my part, I plan to work c.w. as a very important part of my job until 1992 when I will be 90 and maybe ready to lay aside my key. So let us not either underestimate or overestimate c.w. When my ship leaves the West Coast I can work KPH or KFS every day westward until Malacca and WSL can be worked every day eastward to Strait. And when we leave the East Coast, WCC Ceylon. In each direction it is c.w. that does the job. Between Ceylon and the Malacca Strait it is a little sticky to work either coast of the U.S. I have to shop around some to find the right frequency to work one coast or the other and also shop around for the right time of day.

The other modes are fine and I wish them well and I guess when c.w. can be supplanted by another mode it will be done.

Noble H. Ireland, Radio Officer
S. S. *The Cabins*, WSUD

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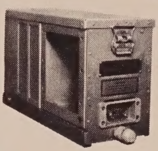

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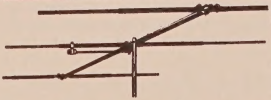

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160 Meter Contest [*from page 60*]

ZD9, KV4, W4 all 2 X s.s.b. I will be operating next year's contest from a new QTH, possibly MP4B land. (In the Contest Roger worked only one W/K and that was K2GNC. However, since then he has worked many here in the States. He is also ex-ZB2AY). VK6NK: A very FB Contest but for us in Australia a very trying one at the time of year chosen. January to March is our summer and cyclone season. This, in turn, causes a lot of tropical storms. This year it couldn't have been worse as we had a cyclone during the week to the north and were suffering the results over the contest weekend. QRN was S9 plus and the poorness of my log is the result. I would get the call after a long listen and then fight to get the report with static crashes every second or so. This isn't good when every station is DX at a minimum of 2,000 miles. If it hadn't been for the QRN many more would have been worked; they were there calling but only parts of calls could be logged. A great pity with VP7 missed as well as well as W6/7 and many others. *VK3RJ:* Time of year unsuitable for Oceania. QRN S7/8 and continuous. A few weak east coast W's were heard 1st nite but too weak to identify. *VK3QI:* Lost half my antenna about an hour before sunset. Heard W5RTQ, 5 W6's, 3 JA's. Nothing else from anywhere. *VK3XB:* I was heard and called by K1PBW but missed him—nuts! *OE1KU:* Condx for DX was here very poor. *VP9BO:* Condx very good 1st nite. Sigs outstanding from N. & S. but not much heard from Eu. QRN 2d nite made receiving almost impossible. Had best local turnout with three stations on—VP9GR, VP9FW and myself. In all, a good weekend meeting old friends. *VP9GR:* Heavy QRN 2d nite. Band open only in the evening from Bermuda. *PY1MGF:* As can be seen from my log, condx were excellent as far as sig strength is concerned but QRN kept most stations from getting thru. Many stations were heard calling but QSOs were just no possible. The following morning QRN was slightly better but condx were "one-way." 1½ hours of calling CQ didn't even result in the faintest QRZ although sigs were about the same as Saturday morning. Anyway, glad to have been able to deal out a few points and multipliers. Power 750 watts into 1/2 wave horizontal end fed wire not up very high. Looking forward to another FB contest next year. PJ2VD: Static level here below normal. So I heard a lot but again I couldn't get into Europe. Readable were OK2BOB, GM3YCB, HB9NL. Heard a crowd of G's 2d nite but too weak for a chance to QSO. Worked this time 10 countries, a good increase related to last year. The 2d nite was very hard probably due to the high static level in Eastern USA. Probably this was my last PJ2—160 activity as in July I return to PAO land and old call PAOVDV. *OK1DIM:* Bad condx. *OK1DVK:* This year very bad condx for DX contacts. Little participation of European stations except for G and OK. I called 4 new countries but no QSO—SVO, ZD8, KV4, HKO. *EI9J:* Condx into Eu were okay but poor for DX. Heard good sigs from W9UCW/HKO. Sunday morning condx across the pond seemed even poorer with only a few W's being heard. We can only hope for better condx next year. *G3VRW:* I found that contest very enjoyable although it is a great pity that condx into USA weren't better. *G3HZL A:* My best effort so far and when better organized hope to do much better. Had to QRT Saturday to return to home QTH to do some domestic chores. The W, VO and KV4 are my 1st contacts outside Eu. Condx didn't seem to be up to other years. Heard and called were HR and HK0. *G3XTT A:* I was confident I could stay awake for the whole of the contest but my confidence didn't prove to be justified! *G2DC:* Enjoyed the contest as ever but was rather disappointed. Heard all W districts (except W7), VE1 and 2, KV4, PJ2, YV yet I couldn't raise one of them. Guess my 9 watts and low antenna not adequate. *G3NT:* Very poor condx here. Low sig strengths. Regret was unable to continue in contest on Sunday. *OH2BR:* One of the best contests I've ever participated in. Heard Eu stations calling VO1FB and VE1ZZ but I didn't hear any DX. Next year will put up the real thing for an antenna. *DJ6TK:* The best signal I heard was Herb, KV4FZ. Very sorry but it wasn't possible for me to work more DX than VO1FB. *KH6IJ:* For some reason I couldn't hear any of the east coast boys except W3IN. Perhaps I missed the opening when I was so busy working the JA boys. The 1st nite was superb but the 2d was no good. The west coast boys didn't seem to be having much luck with the east coast either. *HR2HH:* Condx excellent Friday nite but couldn't work too late. Saturday static almost impossible to copy. Tried very hard again on the top end to work west coast but only one heard was W6KWE/6. Heard nothing from Eu these nights. ((You were heard in Eu, Hal, and called —*ed.*). *VS6DO:* I wasn't on the 2d day as I was working. Many other stations were heard but nobody really knew what freq. I was on except Tom, W6KWE/6, with whom I had arranged a sked. On 160 I run about 10 watts and the antenna is a lashed up job of 180′ end fed and 160′ high. I only put it up for Dale, W6VSS, to make the 1st W/VS6 160 QSO. I have heard W7DOL/6 peaking 599. There appears to be 2 peaks to W6—one just before their sunrise and one immediately after. They don't receive me when their sigs are at a peak. Next year, starting from the middle of October, I will be on again with a much better antenna. *GD3HQR:* Seems hardly worth putting this log in the mail. Trouble here is twofold. A—Don't have time to seriously enter contests. B—On 160 it's impossible for me to work W/VE because I only have transceiver so not easy to work spot frequencies and, of course, only a tiny antenna. But I do try just to put in an appearance. This year condx here were poor over the contest weekend. I don't think GD3TNS was on at all. *JA7OA:* Real thrill to work DX stations (W7, KH6, JD1, KR8) during *CQ* 160 Test. But condx was some poor here in JA land. *JA3AA:* I couldn't QSO Eu and today heavy local QRN. I received W5RTQ peaking 599 at 1300Z. VFB. Called him but ng. Also heard W0YM? on 1992 kc at 1240Z 349. *JA7COI:* I was very sad to receive RST 229 from KR8AG and could not contact with JD1, KH6, W. I'll make up good antenna next year. *PA0LOU:* Poor antenna situation prevents really doing something. Heard ZD8AY, KV4FZ, PJ2VD, VO1FB, VE1ZZ but no W/K. *GI3WSS:* Condx didn't appear as good as last year. Noise level higher. Heard some W's but need a bigger and better antenna. However, the *CQ* 160 M. WW bring 160 to life. *JD1ABH:* I work at Chichijima weather station on Ogasawara Islands (ex-Bonin & Volcano Islands). *OA8V:* Murphy's law sure was working here in Peru. Inverted Vee and severe interaction with tower guys. Sidetone monitor went on the blink and XYL had pneumonia. Had to baby sit. Next year hope to run 100 watts, max. power here in Peru and have my code speed up. Sure rusty now! Also, thunder and lightning with rain 1st nite. 2d nite condx better but overslept! Heard W6KWE/6 and W7DL. *VP2KX:* I regret that the only QSO I had was with KV4FZ. I did hear 9Y4NN and W5RTQ but didn't make QSO. If I'm still around for the next contest I shall hope to be able to give you a better listing. *GM3IGW:* Heard lots of DX but we couldn't break thru the QRN curtain. *GM3YCB:* Heard YV1OB 589. W stations not listening for Eu. Condx lousy. QRN 20 db over most of test. Roll on next year! *HB9NL:* I have heard many W's and YV1OB. The surprise was W9UCW/HK0! Very, very fine condx in the morning between 0300/0730 GMT. K1PBW was 599, the biggest here. *HB9CM:* Sorry, this time nothing positive. Great hope from Asia, Africa, SA but just few USA and a lot of Eu. Contest is not the best time for DXing. *HB9QA:* With my rig I cannot contact the States. More input is necessary. I called K1PBW long time but no QSO. He was 3/579. *9Y4NN:* The 1st day of the contest was not bad as you can see from my log. However, I didn't make a single QSO the 2d. Condx here were very bad. I heard only 3 W's the 2d nite. I coul dhear KV4FZ, YV1OB and W9UCW/HK0 very well throughout most of the test. However, when I closed station at 1200Z the 31st, condx were so bad that I was having trouble copying W9UCW/HK0. That ends my 160 activity here as I'm going back to the States where I'm W4KXI. *YV1OB:* Very strong tropical QRN. *KV4FZ:* The contest was great this year except for the QRN the 2d nite.

Amateur Satellites *[from page 27]*

radio. It is expected that amateur satellites will serve both as a tool and as a catalyst to encourage participation and experimentation, especially among the younger generation who will be the engineering and scientific leaders of tomorrow.

Amateur radio has served as a clearing-house for ideas and a proving ground for many of the major technical and operational developments in the field of radio communications, and it can certainly be expected to play a similar role in space. The knowledge and experience gained with amateur satellites will, no doubt, hasten the development of similar non-amateur small terminal satellite systems such as those that may be required for education and emergency applications, for mobile use, and to provide communications in sparsely populated areas.

Amateur radio is dynamic and its future in space looks even more exciting than its past. From its beginning at the turn of this century, amateur radio has grown to where there are now approximately 450,000 duly authorized persons participating in this service. Radio amateurs are located in nearly every country of the world, with the greatest concentration in North America and Europe.

In the tradition of amateur radio, amateur satellites, regardless of where they are constructed or by whom they may be launched, will be available to radio amateurs *everywhere* on a completely free access basis, and to share equally in their benefits.

Radio waves do not recognize frontiers or political, economic or social barriers. Personal radio contacts between radio amateurs of different origins, nationalities and cultures foster—more than one may realize—a spirit of union and friendship, of peace and understanding. This aura of commonness which unites radio amateurs is a bright symbol of hope for the future. This is the real spirit of amateur radio and the one that sets it apart from all other radio services, whether terrestrially or in space.

Acknowledgement

The authors wish to acknowledge that this article is based upon the efforts of a very large number of radio amateurs, much too numerous to mention individually, but without whose assistance this article would not have been possible. ■

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the W6 a good shot without breaking through the "East Coast Curtain" and is highly responsible for W6's good showing on the various Honor Roll's. Another long path opening to the area around India is good during the winter months at sundown with the beam over South America. Probably the most consistent LP opening is the sunrise path to ZS which is open most of the year but best in the summer months.

40 Meters — This band shows remarkable consistency with good seasonal openings to most parts of the world, however, during the sunspot low openings to Europe and the mid-east at sunrise increase greatly. The long path is open almost the year 'round to ZS, however, activity is not great.

80 Meters—In W6-land little was known about 80 meter propagation until the event of 5 Band DXCC. As the 1969 start date of this award coincided with a sunspot high, it was not until the completion of a year before much was known about propagation on this band. As is true for other bands, there is a long path sunrise opening to Europe and the mid-east although signals are weak. Probably the most frustrating experience for a W6 is to listen to East coast and mid-west stations work Europeans with no trace of signals on the West coast. Openings to Europe are very brief and seem to peak about 0600 GMT during the winter months. The most dependable openings seems to be to the Caribbean and ZS with good openings to southeast Asia during winter months. In January of 1970 HS5-ABD peaked 20 over S9 at 1500 GMT and EP2BQ was worked via the LP at 1500 GMT. The Southern California DX Club made quite a project of 5BDXCC and 7 club members have received the coveted plaque so far.

Far East DX

DX activity seem to be on the increase in the Far East with activity or operation plans from AC3, AC5, BV, BY, XU and XZ. Of course the biggest question is in regard to operation from China as BY1AB and BY3-NK have been heard and worked by West Coast stations. A diplomatic inquiry of the Peoples Republic authorities has been made and *two* amateurs have been reported to be licensed, however, call signs are not known. As of this writing no definite information is available and many are hoping for a BY QSL!

On Taiwan, BV2A operated by Tim and Jim continues to be active on 14021 c.w. while BV1USE has been reported on 14195 s.s.b. In Bhutan, AC5PN was QSOed by W6's in July and August on 14035 c.w. The operation is by Yonten, a Communications Officer with the Bhutan Government. As AC is not an official prefix issued by the ITU to Bhutan there is the possibility that a prefix will be requested. In neighboring Sikkim, King, AC3PT has been active on 14 mc s.s.b. but somewhat difficult to QSO due to the pile-ups! By this time it is hoped that VE7IR has been active from Cambodia and demonstrated amateur radio to XU officials. VE7IR also hopes to be active from XZ, however, a transmitting ban is still in effect in Burma and none of the 12 licensed XZ's are allowed on the bands.

160 Meter News

Below is the 1971/72 160 Meter DX Test Schedule courtesy of W1BB. Based on summer activity and the declining sunspot activity we should have an outstanding winter on the top band. The past summer activity was good as KL7HEE worked Antartica, ZL's/VK's worked W's, KV4FZ made 160 meter WAC in less than 24 hours, while MP4BJI worked Europeans and W's. On the West Coast W6-NUT (ex-W6KWE) logged PY2BJH, PY1-DVG, VK3ATN, VK3AML, KL7CL, L1-AYG, OA8V and KV4FZ during the months of June and July. With all this activity our most interesting winter season on 160 should be in full swing. Good Luck!

1971/72 Transatlantic 160 Meter DX Tests

GMT DATES: Nov. 28, Dec. 26, Jan. 9, Jan. 23, Feb. 13.

TIMES: 0500-0730 GMT.

FREQUENCIES: W/VE east and west (except Hawaii) 1800-1810 kc. Hawaii 1975-2000 kc. Europeans 1823-1830 kc (mostly).

CALL: CQ DX TEST at alternate 5 minute periods. W/VEs leading off. Set clocks *accurately*. Keep accurately to periods unless in QSO.

1971/72 Transpacific 160 Meter DX Tests

GMT DATES: Nov. 6, Nov. 20, Dec. 4, Dec. 18, Jan. 1, Jan. 15, Feb. 5, Feb. 19.

TIMES: 1330-1600 GMT.

FREQUENCIES: W/VE east and west 1800-1810 kc. JA's 1907.5 to 1912.5 kc. ZL's 1876 (approx.). VK's, etc. 1802-1805 kc.

Call: CQ DX TEST in 5 minute periods, W/VEs leading off, JAs take alternate 5 minute periods. Set clocks *accurately*. Keep to periods unless in QSO.

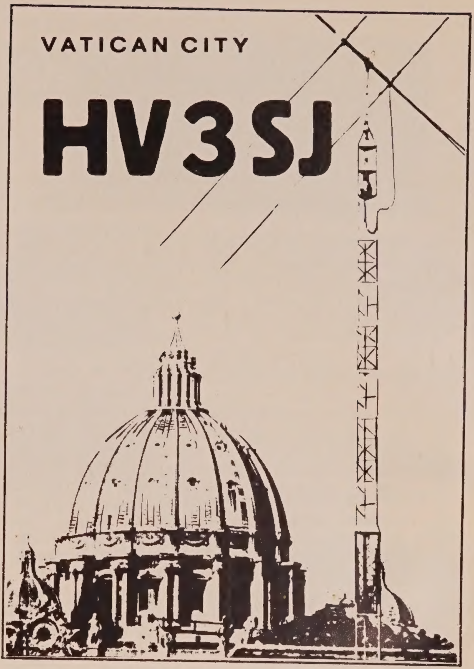
JA/Sunset: JA-*Sunset* tests—same dates—but 0730-1000 GMT Sat., or 11:30 P.M. Friday to 2 A.M. Sat. W/VE West coast time (4:30-7:00 P.M. JAST).

New CQ DX Committee Member

We are glad to welcome Bob Ferrero, K6AHV as the new Northern California DX Club Committeeman. Bob is authorized to verify QSL's for WAZ and *CQ* DX Awards for the Northern California area and may be reached at Ham Radio Outlet, 999 Howard Ave., Burlingame where he is the new proprietor. Bob has been active in DX contests for many years and is known for his snappy operation and FB antenna farm.

QSL Information

CR4BC—*NOT* Via K4DSN. QSL to Julio Vera Cruz, CR4BC, P.O. Box 36, Mindels, Cape Verde Islands.
CR5AJ—via Box 68, Sao Thome, West Africa.
CT2AK—via VE7BWG.
CT2BB—via W3GMN.
DA1JP—c/o WB6PNB.
F0CH/FC—c/o HB9TL.
FM7WN—via K2KGB.
FM0IX—via W7VRO.
FO0TG—to JA1DCY.
FP0BG—to VE1AIH.
FP0CA—c/o K2OJD.
FP0CV—c/o W2GKZ.
FP0LK—via WB2RLK.
FY7AE—to WB4WTG.
GD3RZI—to G3RZI.
GD3WJN—via G3WJN.
HC8GG—via K9YBC.
HK0BKX—c/o WA6AHF.
HK0BMO—to WA6AHF.
HS3AM—via WA6AHF.
HT1MG—via WA5GFS.
JD1ACH—to JA3GZN.
JY9BI—via DK2BI.
KA2AI—via WA6AHF.
KC6EJ—c/o WA6AHF.
KG6SF—to WA6AHF.
KG6SI—to WA6AHF.
KW6EO—via WA6AHF.
KW6GA—via WA6AHF.
KY4CD—to W4DQD.
WS9UCI—2831 Northampton Dr., Apt. 304, Rolling Meadows, Ill. 60008.
KQ0NEB—c/o W0YOY.
KW0SCF—c/o W0BRB.
W7UXP/KH6—to KH6HCM.
OB8V—via W9GFF.
PY0AD—Box 168, 5800 Joao Pessoa, Paraiba, Brazil.
PX0AD—via PY4AP.
PZ1DC—c/o WA6AHF.



HV3SJ will be active in the 1971 CQ CW DX Test with operators DL1CU and DL9PF at the key. The station custodian, Brother Ed normally operates only phone.

TY3ABF—B. P. 504, Cotonou, Dohemy Republic, W. Africa.
VB1MSA—c/o VO1FX.
VK3UV/VK9—to W7VRO.
VK0TM—to K3RLY.
VP1AJ—c/o W4VPD.
VP2MAC—via VE3GCO.
K2YGM/VP7—Box 1175, L.I.C., N.Y. 11101.
VP8ME—c/o WA5FWC.
VQ9GA/C—c/o WA6AHF.
VQ9GA—via WA6AHF.
VQ9DH—via WA6AHF.
VU2HLU—to W0PAH.
VU2JEZ—to WA7MUY.
YB3AAY—c/o W3BRB.
ZD8GA—via WA6AHF.
ZD9BL—to WA6AHF.
ZF1WF—c/o K4CDZ.
ZL4OL/A—c/o ZI2GX.
3A0FN—via DL4VA.
3V8ZK—via F5ZK.
5A0ZZ—to WA6AHF.
5X5NA—to G3LQP.
5X5NF—c/o VE6AKV.
8P6DR—via G3JUL.
8P6DM—to W7VRO.
9V1QJ—via WA5UHR.

73 & DX, Jerry, WA6GLD

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The AutoLevel is the first major breakthrough in volume processing in years. This unique device regulates the input signal to provide *14 db* of compression. It is ideally suited to SSB and AM and may be used with ALC systems. A built-in bypass switch allows you to feed the microphone straight through. Provision is also made for push-to-talk operation. The AutoLevel is not a *clipper compressor - all regulation is accomplished with a fast-acting photosensitive resistor that electronically regulates the input with a minimum of distortion.* If you would like to increase your average output and still maintain a clean signal, the AutoLevel is the volume compressor for you . . .

Features:

- 14 db of compression (minimum)
- 115-volt ac power supply
- Input bypass switch
- All silicon transistors
- G-10 fiberglass printed circuit board
- Simple installation (installs in microphone lead).
- Price: $87.50

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It may take some doing, but you CQ 'Ham' operators could put a plan into motion that could circle the globe. How? In a nutshell: Ask all who are Worshippers in a Religion, to give, EVERY WEDNESDAY, at least 10 seconds of time in thought or prayer, for World-Peace and Domestic-Peace. Timed from Midnight Tuesday's to Midnight Wednesday's, every week, in all Religions, in every Country.

PRAY FOR PEACE

Ask each Worshipper to try the Plan and ask him or her to describe it to others, by Voice or by Letter.

Imagine thousands upon thousands praying in unison during the same 24-Hour period, every week, for the same purpose.

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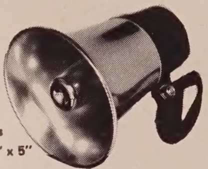
Introductory Price



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Size 6" x 5"

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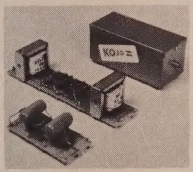
KOJO AUDIO FILTERS FOR SSB AND CW



Greatly improves reception on all receivers. Removes h.f. audio hiss, background noise, and ssb buckshot.

SSB filter provides sharp cutoff and rejection>30db above 3500 Hz. Low-Z for phones or speaker.

CW filter has spot resonance at 780 Hz; 40db passband of 1100 Hz. Passband peak 100 Hz at -3db. Low-Z input; High-Z output.

Top grade components throughout. Kits supplied with simplified instructions. Deluxe models assembled in gray cabinets with in-out switches.

C.W. Kit $7.95; Deluxe $15.95; SSB Kit $11.95; Deluxe $19.95.

All filters shipped postpaid. Arizona residents add 4% sales tax.
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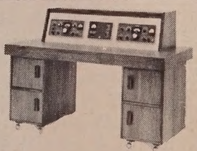

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T-4XB Transmitter

Frequency coverage and VFO similar to R-4B • USB/LSB • Semi break-in CW • Controlled Carrier AM • VOX or PTT • Adjustable Pi-Net • Xmit AGC, no flat topping • 200 watts • 8 pole SB Filters

Transceive with R-4B or T-4XB VFO or use separately. **$495.00**

L-4B Linear Amplifier

• 2000W PEP-SSB, 1000W AM, CW, RTTY • Class B Gnd Grid • Broad Band Tuned Input • RF Neg Feedback • Xmit AGC • Directional Wattmeter • Taut-band Meters • Plate Current Meter meets FCC reg • Quiet hi-volume blower.

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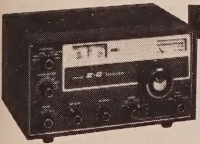
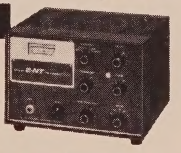


2-C Receiver

• Xtal control 1st converter • 500 kHz Ranges: 80, 40, 20, 15, 10 meters • Accessory Ranges 3-30 MHz • SSB-AM-CW • Accessories: Spkr, Q-Mult, Calib, Noise Blanker, Xtals.

Amateur Net $255.00

CW Transmitter 2-NT



• 100 (or 75) watts • Break-in CW with 2-C • 80, 40, 20, 15, 10 mtrs xtal controlled • Ant. Relay • Sidetone • LP Filter • Pwr. Sup. incl.

Amateur Net $164.00

TR-44B Communications Station • Consists of R-4B and T-4B in same cabinet • Less power supply and crystals **$975.00**

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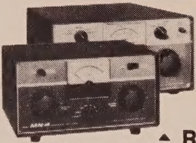


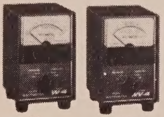
MN-4 MN-2000

Matching Networks

Integral Wattmeter: fwd pwr in watts and VSWR direct • Can read refl pwr • Matches xmtr to ant VSWR 5:1

MN-4 .... 200 watts .... **$ 99.00**
MN-2000 2000 watts PEP **$195.00**

RF Wattmeters



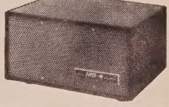
W-4 WV-4

Fwd and refl pwr directly in watts • Two scales each direction • Calib Acc: ±(5% of reading + 1% of full scale)

Model	Range	Full Scale	Price
W-4	1.8-54 MHz	200/2000W	**$61.95**
WV-4	20-200 MHz	100/1000W	**$73.50**

Matching Speaker MS-4

5"x7" speaker, space for power supply **$22.00**



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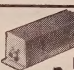
Model 729-SRD **$17.00**
Standard Crystals, ea **$ 5.00**
Power Supply **AC-4**.... **$99.95**

DRAKE TVI FILTERS

HP

FMS

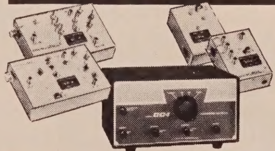
Filter	Price
TV-300-HP High Pass Filter	$ 4.95
TV-1000-LP Low Pass Filter	18.75
TV-100-LP Low Pass Filter	6.50
TV-CB-LP Citizens Band	7.65
TV-300-FMS FM Band Stop	4.95
TV-300-FMI FM Tuneable	4.95
LN-4 Power Line Filter	8.00



LP

LN

DRAKE 2 and 6 Meter CONVERTERS



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6 meters	**SC-6**	**$71.00**
2 meters	**SC-2**	**$76.00**
Power Supply	**CPS-1**	**$19.75**
VHF Xtal Cal	**SCC-1**	**$26.95**
Console	**CC-1**	**$26.95**

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TC-2 • Entire 2-meter band • 180 watt input
TC-6 • All of 6-meter band • 300 watt input

BOTH: • Xmit AGC—no flat top • Antenna Relay • Need no separate pwr supply with Drake xmtrs. **TC-2 $300.00; TC-6 $250.00**

SPR-4 PROGRAMABLE RECEIVER • All solid state • 1 kHz acc. dial • 3 bandwidths • SSB-AM-CW • 24 500 kHz ranges 150 kHz-30 MHz (10 ranges furn., others $5 ea.) • 12 VDC/120 VAC • Acces avail: Calib, Noise Blanker, Notch. **$499.95**

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MINEOLA, N.Y. 11501 525 Jericho Turnpike, One Half Block East of Herricks Road
TOTOWA, N.J. 07511 225 Route 46, 201-256-8555
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PLEASE USE YOUR ZIP
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CORRESPONDENCE

Zero Beat [*from page 48*]

Zeroing The Crystal Calibrator

With the receiver b. f. o. turned on, tune in WWV while watching the scope and find zero beat with sine wave collapsed; then switch on the calibrator and vary its frequency as you did previously with the transmitter. This procedure will enable you to set the calibrator exactly with WWV. Of course, allow sufficient time for warm-up before attempting to calibrate.

The Heath Monitorscope can also be used for the entire zero beat procedure if that is the only scope in the shack. The only difference will be that you have fewer controls to be concerned with. The sine wave will still be there but not the lissajous pattern. Connect the output of the receiver to the jack marked VERT. on the rear of the scope and set the function switch to SINE position. This connection may be left in place even though you use the scope on transmit as well.

If you are using a sideband receiver without an a.m. filter the scope pattern will probably not reappear on the other side of zero. Those with an a.m. type receiver or any sideband receiver with an a.m. filter will have the advantage of seeing both sides of zero.

For older hams, such as the author, where hearing is less than keen, the above visual aids will give transceiver accuracy to a transmitter-receiver method of operating.

Acknowledgement is made to WB2FWS for his assistance in the preparation of this article. He is my first harmonic, and gave me the inspiration to get back on the air after a 40 year absence; my call was 3FO! ■

F.M. [*from page 43*]

S.E.R.A.

QSP, the official publication of the Southeastern Repeater Association, as well as that of the Tampa Bay Repeater Association, has been crying for news of SERA. How about it, give Walt Terrie a break with news of SERA.

Finale'

Some of the repeater directory cards were a little late in getting sent out. Also, the cards went through a second printing to get enough to fill requests. Looks good. Several f.m. groups have been participating in local parades, civic drives, etc. This is good publicity for all of us. Well, I've taken up so much room with 220 mc information this go 'round that the Q & A section must be omitted. This will be corrected next month. Maybe, since it will be the first anniversary of the FM COLUMN, we can talk Dick, K2MGA, out of a little more room to celebrate in. Unless something comes up, I'll be seeing some of you at SAROC in January, and in Corpus Christi in February for Texas VHF FM Society meeting. Best of luck, happy holidays, and see you next year. ■

Heath IM-105 VOM [*from page 33*]

ment is about 7″ × 5″ × 2¼″ (H.W.D.) and it weighs around 2 lbs. with batteries. The case is blue-green and the panel is gray.

Operation and Performance

The ranges are switch-selected, except for the 1000 v., 5000 v. and 10 a. ranges which necessitate moving one of the test leads over into a separate related jack and setting the range switch to a specified position.

There are three calibrating controls that are accessible when the front panel escutcheon is snapped off the case. Calibration can be made against a known-voltage source or in conjunction with a 1.5 v. D cell. The accuracy thus largely depends on the accuracy of the known calibrating source. After calibrating our unit against a D cell, the overall voltage accuracy fell within the specified tolerance when checked against a voltage calibrator and other instruments of known accuracy. Checked against a 1% resistance bridge, the ohms readings also came within the rated tolerance. A nice feature with this function was that no singificant resettting of the OHMS-ADJUST control was needed when switching between ranges. The tolerance on all functions also was maintained regardless of the physical position of the instrument, indicating a well-balanced meter movement.

The Heath Model IM-105 v.o.m. is priced at $47.95 (kit including material for test leads). It is a product of Heath Company, Benton Harbor, Michigan 49022.

—*W2AEF*

[1] Batteries are not supplied with the Kit. A problem we encountered with the 15-volt battery is that the required type is not readily available at local radio shops. Fortunately, however, replacement of this battery (needed for only the ×10K ohms range) will not be required as often as that of the D cell might be.

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POWER-MITE TRANSCEIVERS

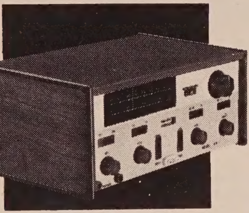
PORTABLE /LOW POWER /LOW COST

TOP TRADE & TOP DEALS FROM THE FASTEST GROWING DEALER IN THE WEST

Put more adventure into Amateur Radio

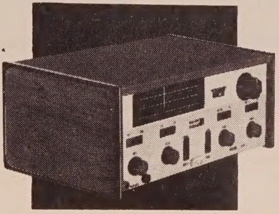
The Power-Mite includes a Synchrodyne direct conversion receiver and solid state CW transmitter. Drift is less than 100 Hz. Adequate receiver sensitivity even for "down under" DX signals. An "M" derived filter provides 2 KHz selectivity. Built-in side-tone, receiver muting. Integral break-in keying with adjustable delay (PM 3A only) makes operating virtually effortless. Keying is clean and wave shaped for easy copy.

A compact Power-Mite transceiver excels as a traveling companion. It needs only an antenna, key, headphones and a lantern battery for instant CW communication wherever you are.



POWER-MITE PM 3 $69.95
POWER-MITE PM 3A $79.95

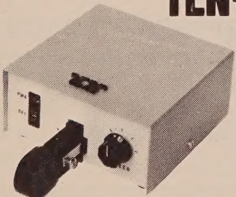
Old timers who are a little bored with high power are finding the Power-Mite a refreshing challenge. Beginners experience all the thrills of conquering distance and making new friends.



PM 2 .... **$54.95**
PM 2A (with side-tone) **$59.95**
PM 2B (with side-tone and 20 meters) **$65.95**

Ideal for the Novice, portable operation, QRP work and emergency service. It may be used to drive a linear amplifier.

TEN-TEC KEYERS



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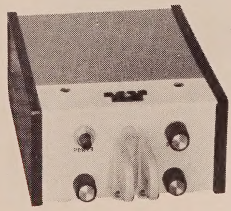
KR5 **Price $34.95**



MODEL KR20

A popularly priced line keyer without the squeeze feature. Excellent "feel" for smooth, easy to copy CW at any speed. Self completing characters. Side tone. Two position weighting control.

KR20 **Price $59.95**
Keyer less paddles

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Amateur Net

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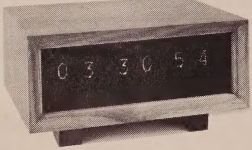

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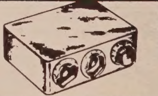
160 METER ANTENNA



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MAGAZINES FOR SALE: CQ/QST/Ham Radio, issues at 10 cents each (plus shipping) from Lockheed Ham Club, 2814 Empire, Burbank, Calif. 91504. Send list and check. Available issues and any refund due will be sent promptly.

WANTED: Tri-band beam to be used in Northern California area. K5ENL, Rte. 4, Box 127, Grandview, Tx. 76050.

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Hallicrafters HT-37. Mint condx. $200.00. Hallicrafters SX-111, $145.00. Marine Electronics, 76 New York Ave., Halesite, L.I., N.Y. 11743. (516) 427-7199.

SAROC-HAM RADIO MAGAZINE Cocktail Party, January 6, 72, all one can drink for one hour if you can elbow your way to the bar. Flamingo Hotel, Las Vegas, Nevada.

TELREX beams, new, orig. pkg. 6 el. 20m, 10el. 10m 3el. 40m all for $1000. New cost $2000. E. Flinn, Jr., Box 100, Carrollton, Ga. 30117. (404) 834-2000.

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WANTED: Junk or non-working transceiver, What have you? WA7NCT, 2542 Yellowstone, Billings, Mt. 59102.

Punch through the QRM, get 10 DB talk power boost with AMPRESS speech processor. Only $39.95. C. E. Cox Company, 2415 S. Broadway, Santa Ana, Calif. 92707.

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LMU 41 MOTORS for mdl 28 and 35, Teletype, Universal voltage, series governed, with RF fil ter New, $26.00 200V 6A triac 80 cents. SASE for list. Doug Craton, 5625 Balfrey Dr., W. Palm Beach, Fla. 33406.

FOR SALE Lampkin 105B with all manuals, used very little, $150.00 will ship. W9PPP, 1305 Jefferson St., Racine, Wisc. 53404.

SPARE COPY: Ham Radio-Feb. '70 needed by G3-MYT. Via Ken Van Andel, WB9FRV, 1371-A Monomoy, Aurora, Ill. 60506.

SELL: Royal Deluxe Portable Typewriter with Engin. symbols installed by Royal. Touch Control 2 color ribbon, Exc. condx. Best offer. W2ASI, 15 KensingtonOval, New Rochelle, N. Y. 10805. (914) NE 3-7077.

Lampkin Type 105-B micrometer. Frequency meter with engineering data sheets. Like new, hardly used, in original carton. $150.00. Marine Electronics, 76 New York Ave., Halesite, L. I., N. Y. 11743. (516) 427-7199.

WANTED: Drake T4X. Southern California area. WA6CMX, 1463 Silvius Ave., San Pedro, Calif. 90731.

WANTED TO BUY: Tech Manual for C of E Generator Set, 1 1/2 kw, 3600 rpm Homelite Model 24A120-23, Stock No. 17-5401-500-000. Also need carburetor or modification kit information. 1007 Janlee, Burkburnett, Texas. 76354.

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SELL: Eico 753 Transceiver/751 PS. Complete w/ manuals and modifications. $130. K6ZTA, 4456 Balboa Ave., Encino, Ca. 91316. Phone 213-981-2426.

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SB10, Mod. per May 1970 "CQ", $75. Apache $75, HR10, $35. All good cond/w/manuals, FOB. W6-TTS, 1016 Masonic, Albany, Ca. 94706.

FOR SALE: Ham-M Antenna Rotor 1971 Model with Control Box, $75. W7AVS, 7818 E. Oak St., Scottsdale, Ariz. 85257.

WANTED: Borrow or buy schematic or manual for Lafayette HE-45B. Bill Stottlemyer, WB4SPR, Box 88, Trezevant, Tenn. 38258.

SELL: Eico 720 Xmitter, excellent, $60, Hammarlund HQ100, good $65. 8 Novice Xtals, $10.00. D. Ferraro, 35 Hastings Drive, Stony Brook, New York. 11790.

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SELL HEATHKIT: HW100, $230, HP23, $45, HW32 $80, HP13, $55. HDP-21A mike $20. K0-VVR, M. Swink, 9516 W. 87, Apt. B, Overland Park, Kansas. 66212.

WANTED: 8907-8906-7211 tubes. 500 cycle filter for 75A-4. Automatic keyer. Surplus. Yaesu Receiver. FRDx400. G. Vilardi, WA2VTR, 14 Oakwood Terr., Spring Valley, N. Y. 10977.

WANTED: Old radio receivers, broadcast and communications, such as Kennedy, Clapp-Eastham, Atwater-Kent, RCA etc. Erv Rasmussen, 164 Lowell St., Redwood City, California. 94062.

CONCERTONE 61 series, need manual to copy and Capstan motor. K8DTS, 25884 Highland Rd., Richmond Hts., Ohio. 44143.

WANTED: Heath SB610 monitorscope with manual. Exc. cond. Adinolf, 5113 Arvada, Torrance, California. 90503.

75A4 filters, 6KHz, 2.1 KHz, 1.5KHz. First M.O. or Certified Check for $75.00 takes all three. W4-FUI, 260, Rt. 2, Candler, N. C. 28715.

SWAN 250 $225 or best offer. SASE for list of others. WA2GLR, 76-70th Street, Brooklyn, New York. 11209.

WANTED: Heath SB200 or Swan 1200 W Linear Amplifier. State condx and price. W1ODQ, 299 So. Main St., Mansfield, Mass.

WANTED: Ranger I xmitter that needs repairs, may consider one in good working cond if price is right. Stan, W8QKU, 2748 Meade, Detroit, Mi. 48212.

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FOR SALE: CE200V with 160M coils, $395 or trade? E. Erickson, 13 Robert Cir., S. Amboy, N. J. 08879.

FOR SALE: Knight-Kit KG-640 20K-Per-Volt Taut-Band VOM, $30.00. W2AEF, CQ Magazine, 14 Vanderventer Ave., Port Washington, N.Y. 11050.

LAMPKIN: 105B, very clean, best offer over $150, K8DTS, 25884 Highland, Richmond Hts., Ohio. 44143.

HEATH SB-100 complete $175. Plate xformer 3-KV CT one amp plus KW parts. C. Wyman, 4453 Via Pinzon, Palos Verdes Est., Ca. 90274.

51J w/manual and cabinet $295 or swap for 75-A4. Equal condx. Art Ford, 9 Havemeyer Ln., Commack, New York. 11725.

FOR SALE: LM21, LM18 freq. meters, GR650A Imped. Bridge, DuMont 322A Dual Beam Scopes. Johne, Box 109A, Pembine, Wis. 54156.

LINEAR BUILDERS: Send SASE for Low-priced list of HiPower parts. W6RW, 8600 Skyline Dr., Hollywood, Ca. 90046.

SBE-34, Mic., Calib, AC/DC built-in, 4 bands, 135 W., reconditioned, ex. $225. K8RZJ, Columbus, Ohio. 43209.

WANTED: Heath Patch, W2AV Balun, Heath Station Counsel, Coax relay. Tom Dornback, K9-MKX, 2515 College Rd., Downers Grove, Il. 60515.

NEED: Parts for RME 4350 dial. Any help appreciated. WA4UZM, 324 S. Riverhills Dr., Temple Terrace, Fla. 33617.

WANT: Old style Telrex 20, 15, 10 meter beams with cycolac insulators. Also HyGain 402B. W0-AIH, P. Bittner, 814 4th St S, Virginia, Mn. 55792.

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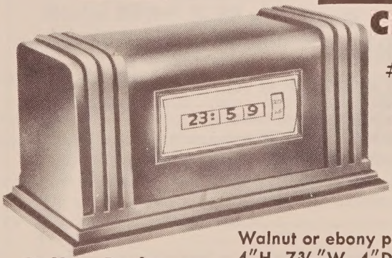

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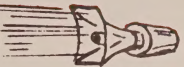

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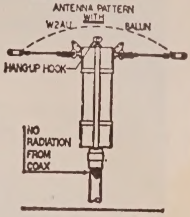
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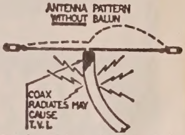
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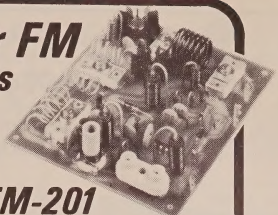

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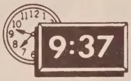

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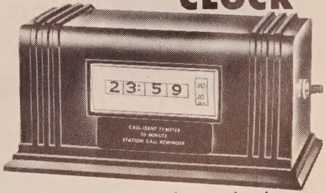

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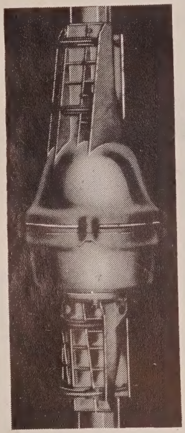

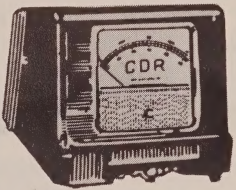

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WANTED: W8FYO Key Lever for Electronic Keyer. 0-1 Amp RF Ammeter, tower safety belt. K9-WEH, 201 E. Marion, Prospect Hgts., Ill. 60070.

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COAXIAL FITTINGS: SO-239 .18 PL-259A .30 UG-290/U .10 UG-262/U .20 UG-58A/U .20 others K. Maas, Burlington, Wis. 53105.

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FOR SALE: Messengers 124 & 323, battery pack, like new. Make offer. Don F. Peyton, Box 487, Lindale, Texas. 75771.

FOR SALE: Allied A-2567 Citizen band xcvr. 23 channel — 12V; 117V power supplies. Like new, used 6 mos. Price: $150. M. Carey, WA4DJF, 815 E. College, Pulaski, Tenn. 38478.

SELL: DX60B $65. HG10B $25. HR10B $65 with extras and very good cond. WA3PXR, 111 Glendale Rd., Exton, Penna. 19341. (215) 363-9356.

NOVICES: Your own traffic net. Eastern area slow net daily 3726 kHz 7:30 est. Info: WA-3OGM Joe Stratton, RFD 1, Box 185, Glen Mills, Penna. 19342.

CANADIANS: Equipment repair and alignment. Fully equipped lic'd technicians kits wired-serviced Bob Fransen, VE6TW, 227 Cottonwood, Sherwood Park, Alberta, Canada.

MECHANICAL FILTERS: 455 Khz. 2.1 Khz, $18.95. 300 Hz, $22.95. J. A. Fredricks, 314 South 13th Avenue, Yakima, Washington. 98902.

WANTED: HW-100 in operational condition and reasonable price. Robert E. Fromm, Jr. 276 Las Lomas, Hamilton AFB, Calif. 94934. 415-838-2768

SELL: Pair of 4X150A tubes $10.00 pair 4-65A $15.00 single 4-125A $12.00 Dumont Scope 304H $65.00. W1ODQ, 299 So. Main St., Mansfield, Mass. 02048.

FOR SALE: Manuals, Pre Prog, Prog Line, Motorola and RCA. F.M. units, also tubes, resisters, trans, and misc parts. Ed. J. Trella, WA1GLJ, 246 Yale Ave., Meriden, Conn. 06450.

ALDEN fully automatic facsimile recorder. 60-90-120 lines per minute. With manuals, $400. R. E. Falkoski, 2301 Dallas, Richland, Wash. 99352.

HQ170C & Matching Speaker. Exc. condx. $175. Art 13 and book $30. 30V and 400V SS PS part built $40. FOB. WA1CFT, RFD 1, Derry, New Hampshire. 03038.

FOR SALE: Cleaning out bookshelf. S9 Signals (by W6SAI), CQ Antenna Roundup, CQ Anthology, CQ Anthology II, $1.00 each, $3.50 for all, postpaid. A. Brogdon, 2956 Hewitt, Silver Spring, Md. 20906.

WANT: ARRL-HAND BOOK 1960 clean will pay $2.00 incl. postage. M. Bae, Box 95, S. Branch, N. J. 08881.

WANTED: 500 to 1000 ft. of Phosphor bronze stranded wire used on planes as trailing ant. wire—Jule Gordon, Box G, Moundsville, W. Va. 26041.

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SALE: HX-50 Xmtr, exc. condx, $150. Allied rcvr A-2515 Gen. Cvg. $45. Tentec PM-3A xcvr. $55. Smith, 12 Dale St., W. Hartford, Ct. 06107. WA1NDX.

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SALE: 2 Mtr. xmtr 25 watts, VFO $25. 5 band Lafayette Pre-amp/Cnvtr, $25. WA9DJR, 5631 S. Oak Park, Chicago, Il. 60638.

WANTED: Used Johnson KW Matchbox or Equivalent; in good condition. WA2LOG, 412 Robin Lane, Vestal, New York. 13850.

SELL: 10 mtr. Quad Ant. new, never used. $18. No shipping. P. Feely, W2BAO, 15 Locust Hill, Yonkers, New York. 10701. 914-YO8-1785.

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SELL: Gotham V-80 Vertical; Ten-Tec AC-5 Antenna tuner; both never used. Chris, WN3QWW, 123 S. 4th Avenue, Lebanon, Pennsylvania. 17042.

WANTED: Surplus AN/URR-27 VHF Receiver.. Ed Alves, 275 So. Marengo Ave. Number 30, Pasadena, Calif. 91106.

VHF MANUAL 6M Receiver, 110V, $12 postpaid. U.S.A. Robert Clark, WB4OJJ, 1644 Reece Road, Salem, Virginia. 24153.

WANTED: Coils and knobs for old National SW-3 receiver. W7KE, 1109 S. 2nd, Hamilton, Mt. 59840.

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WANTED: Brown Bros Ctl Key and Dowkey OK-72 Remote Antenna Switch. Rod, W7YBX, 5632-47th Ave. S.W., Seattle, Wash. 98116.

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FOR SALE: Collins 32S-3, Collins 75S-3B. Collins 516F-2. $1000 certified check or M.O. F.O.B. St. Anthony, Idaho. Schnurie, W7DUP, Rte. 1, Box 216, 83445.

HEATH IM-36 transistor Tester, like new; also GR-54 Recvr. Trade for 2 mtr txvr with internal VFO or make offer. WA2RYC, 25 Meacham St., Belleville, N. J. 07109.

SELL: Heath SG-6 generator $15; O-7 scope $30; A-9C 20W amplifier $20; SS-1 speaker $25; GW-10D CB transceiver $45; DW-2772 CB transceiver $50. Ted Tsucalas, 162-23 96th St., Howard Bch., New York. 11414.

HEATH SB301 with cw filter for sale. Mint, expertly wired. $230. B. Melt, WA1HUH, 10 Woodridge Rd., Wellesley, Mass. 02181.

COMPLETE MOBILE PACKAGE, Heath HW22A, HP13A, mike, speaker, Hustler Ant. w/mount. Will ship, $200. C. Welker, 800 Hemingway, Raleigh, N. C. 27609.

QRM? FILTER (active), audio, 2 pole, variable band-pass Simple to make. Schematic & all info. $2. K3CHP, Joe Mikuckis, 6913 Furman Pkwy., Riverdale, Md. 20840.

FOR SALE: Plans and specifications for 45 ft. crank-up tower, self-supporting, easy to build. SEnd $2 to D & D, 1007 Janlee, Burkburnett, Tx. 76354.

SELL OR TRADE: Leitz Ortholux Research Microscope with all accessories including projection. Also 28-pt. Bristol Strip chart millivolt recorders. SASE brings list. Trammell, 1507 White Oak Ct., Martinsville, Va. 24112.

SELL: DX-60 $50; HR-10B $60. HG-10 VFO, $30. All for $125. Make offer. A.M. Fox, Box 805, Greeley, Co. 80631.

SALE: SB610 Heath Oscilloscope, new, all coils & components. $65.00. Plus postage. Cliff Brown, WA-3GBT, Box 600, Kane, Pa. 16735. 814-837-9683.

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WANTED: G. E. Progress Line FM Receiver Strip Model 4ER25, 150-174 Mhz. W0BQL, 2202 Menlo Drive, Wichita, Kansas. 67211.

FOR SALE: W3QHN Elmac AF-67 AM, and FM, CW Transmitter 160-10 (VFO- all bands 65 watt, $50). PMR-6 Receiver 160-10 and BC $50. Gavin VHF TV converter, $12; RCA Sig. Gen 170KC, 100MC $20. Starfire Copy Machine, $25. Earl W3QHZ, (215) 326-1123.

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POLY-COMM 6&2, $150.00 perfect; HQ140XA, $125.00; Heath VFO, VF-1, Johnson Matchbox. WB6HEZ, Box 1422, Romoland, Ca. 92380.

WANT TO BUY OLD ARRL HANDBOOKS, 1926 through 1931. State price and condition. W3-QII, 5899 Barnes Ave., Bethel Park, Pa. 15102.

CLEANING HOUSE. Eimac 6C21 KW plus triode, never used. $30. SASE for list of meters (500 madc, 100 uadc, etc). Al Brogdon, K3KMO, 2956 Hewitt, Silver Spring, Md. 20906.

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RF POWER OUTPUT, 120 watts, 6-frequency capability. 148–174 MHz. Brand new, in factory-sealed cartons. Includes all accessories not checked out by us. No warranty. **each $345.**

IN QUANTITIES OF FIVE (5) .... each $295.

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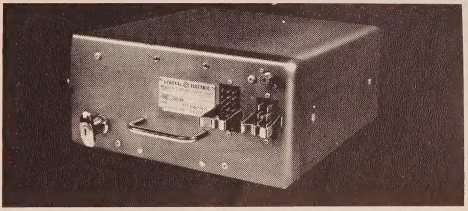

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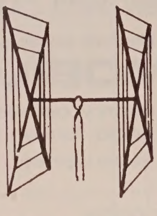

CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount; uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!

10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16′ square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10′ long x 1¼″ O.D.; 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.

Radiating Elements: Steel wire, tempered and plated, .064″ diameter.

X Frameworks: Each framework consists of two 12′ sections of 1″ OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞″ tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.

Radiator Terminals: Cinch-Jones two-terminal fittings

Feedline (not furnished); 52 ohm coaxial cable

Now check these startling prices—note that they are *much lower* than even the bamboo-type:

10-15-20 CUBICAL QUAD	$37.00
10-15 CUBICAL QUAD	32.00
15-20 CUBICAL QUAD	34.00
TWENTY METER CUBICAL QUAD	27.00
FIFTEEN METER CUBICAL QUAD	26.00
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(all use single coax feedline)

GOTHAM
1805 Purdy, Dept. CQ,
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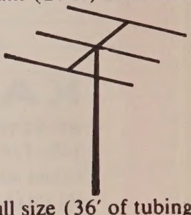
The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



Each beam is brand new; full size (36′ of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞″ and 1″ alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.

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4 EL 20	34*	4 EL 6	20
2 EL 15	17	8 EL 6	30*
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4 EL 15	27*	***20' Boom**	
5 EL 15	30*		

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"All band vertical!" asked one skeptic. "Twenty meters is murder these days. Let's see you make a contact on twenty meter phone with low power!" So K4KXR switched to twenty, using a V80 antenna and 35 watts AM. Here is a small portion of the stations he worked: VE3FAZ, T12FGS, W5KYJ, W1WOZ, W2-ODH, WA3DJT, WB2FCB, W2YHH, VE3-FOB, WA8CZE, K1SYB, K2RDJ, K1MVV, K8HGY, K3UTL, W8QJC, WA2LVE, YS1-MAM, WA8ATS, K2PGS, W2QJP, W4JWJ, K2PSK, WA8CGA, WB2KWY, W2IWJ, VE3-KT. Moral: It's the antenna that counts! *FLASH!* Switched to 15 c.w. and worked KZ5-IKN, KZ5OWN, HC1LC, PY5ASN, FG7XT, XE2I, KP4AQL, SM5BGK, G2AOB, YV5-CLK. OZ4H. and over a thousand other stations!

V40 vertical for 40, 20, 15, 10, 6 meters	$14.95
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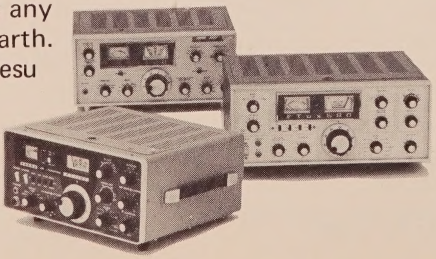

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